On various equations concerning the relativistic viscous fluid in the expanding early Universe. Mathematical connections with several parameters of Number Theory and String Theory.

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Abstract

In this research thesis, we describe various equations concerning the relativistic viscous fluid in the expanding early Universe. We obtain the mathematical connections with several parameters of Number Theory and String Theory.

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Ludwig Eduard Boltzmann

(1844-1906)

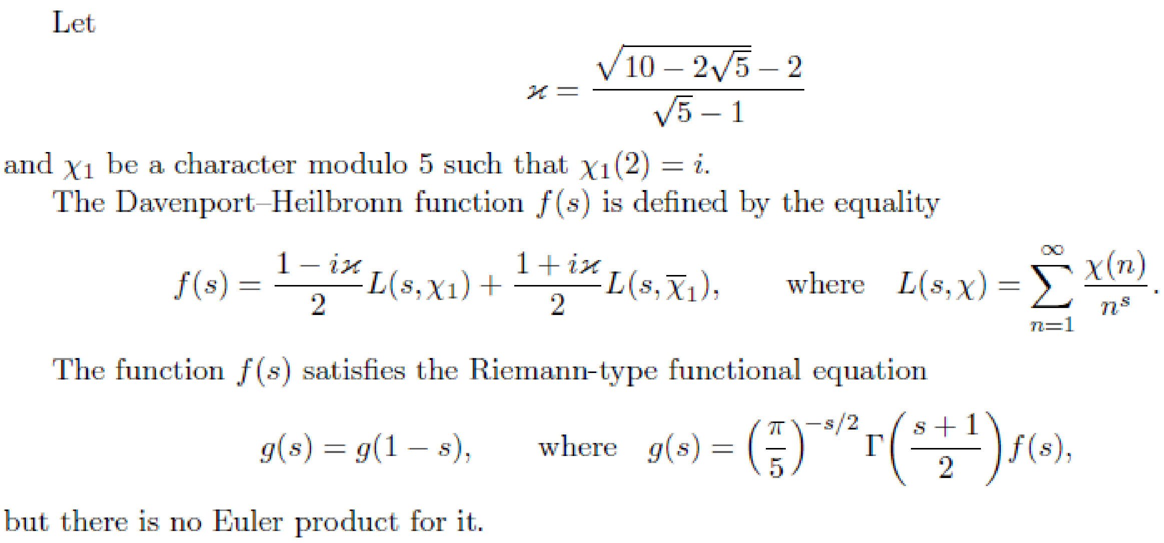
Vesuvius landscape with gorse – Naples

https://www.pinterest.it/pin/95068242114589901/

From:

On the Zeros of the Davenport Heilbronn Function
S. A. Gritsenko - Received May 15, 2016 - ISSN 0081-5438, Proceedings of the Steklov Institute of Mathematics, 2017, Vol. 296, pp. 65–87.

We have:



Let

$$\varkappa = \frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}$$

and χ_1 be a character modulo 5 such that $\chi_1(2) = i$.

The Davenport–Heilbronn function $f(s)$ is defined by the equality

$$f(s) = \frac{1-i\varkappa}{2}L(s,\chi_1) + \frac{1+i\varkappa}{2}L(s,\overline{\chi}_1), \qquad \text{where} \quad L(s,\chi) = \sum_{n=1}^{\infty}\frac{\chi(n)}{n^s}.$$

The function $f(s)$ satisfies the Riemann-type functional equation

$$g(s) = g(1-s), \qquad \text{where} \quad g(s) = \left(\frac{\pi}{5}\right)^{-s/2}\Gamma\left(\frac{s+1}{2}\right)f(s),$$

but there is no Euler product for it.

$$(\sqrt{10-2\sqrt{5}}-2)/(\sqrt{5}-1) = \kappa$$

Input:

$$\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}$$

Decimal approximation:

0.2840790438404122960282918323931261690910880884457375827591626661

…

0.28407904384…. = κ

Alternate forms:

$$\frac{1}{4}\left(\sqrt{10-2\sqrt{5}}-2\sqrt{5}+\sqrt{5\left(10-2\sqrt{5}\right)}-2\right)$$

$$\frac{1}{4}\left(1+\sqrt{5}\right)\left(\sqrt{10-2\sqrt{5}}-2\right)$$

$$\frac{1}{2}\left(-1-\sqrt{5}+\sqrt{2\left(5+\sqrt{5}\right)}\right)$$

Minimal polynomial:

$$x^4+2x^3-6x^2-2x+1$$

Expanded forms:

$$\frac{\sqrt{10-2\sqrt{5}}}{\sqrt{5}-1}-\frac{2}{\sqrt{5}-1}$$

$$\frac{1}{4}\sqrt{10-2\sqrt{5}}+\frac{1}{4}\sqrt{5\left(10-2\sqrt{5}\right)}+\frac{1}{2}\left(-1-\sqrt{5}\right)$$

For ((((√(10-2√5) -2))⁄((√5-1)))) = 8πG; G = 0.011303146014

Indeed:

((((√(10-2√5) -2))⁄((√5-1))))/(8π)

Input:

$$\frac{\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}}{8\pi}$$

Result:

$$\frac{\sqrt{10-2\sqrt{5}}-2}{8\left(\sqrt{5}-1\right)\pi}$$

Decimal approximation:

0.011303146014005214797375012944203574468576031392001780859490966 7…

0.01130314…. = g (gravitational coupling constant)

Property:

$$\frac{-2+\sqrt{10-2\sqrt{5}}}{8\left(-1+\sqrt{5}\right)\pi}$$ is a transcendental number

Alternate forms:

$$\frac{\sqrt{10-2\sqrt{5}}-2\sqrt{5}+\sqrt{5\left(10-2\sqrt{5}\right)}-2}{32\pi}$$

$$-\frac{1+\sqrt{5}-\sqrt{2\left(5+\sqrt{5}\right)}}{16\pi}$$

$$\frac{-1-\sqrt{5}+\sqrt{2\left(5+\sqrt{5}\right)}}{16\pi}$$

Expanded forms:

$$-\frac{1}{16\pi}-\frac{\sqrt{5}}{16\pi}+\frac{\sqrt{10-2\sqrt{5}}}{32\pi}+\frac{\sqrt{5\left(10-2\sqrt{5}\right)}}{32\pi}$$

$$\frac{\sqrt{10-2\sqrt{5}}}{8\left(\sqrt{5}-1\right)\pi}-\frac{1}{4\left(\sqrt{5}-1\right)\pi}$$

Series representations:

$$\frac{\sqrt{10-2\sqrt{5}}-2}{(8\pi)\left(\sqrt{5}-1\right)}=\frac{-2+\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9-2\sqrt{5}\right)^{-k}}{8\pi\left(-1+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)}$$

$$\frac{\sqrt{10-2\sqrt{5}}-2}{(8\pi)\left(\sqrt{5}-1\right)}=\frac{-2+\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(9-2\sqrt{5}\right)^{-k}}{k!}}{8\pi\left(-1+\sqrt{4}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)}$$

$$\frac{\sqrt{10-2\sqrt{5}}-2}{(8\pi)\left(\sqrt{5}-1\right)}=\frac{-2+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(10-2\sqrt{5}-z_0\right)^k z_0^{-k}}{k!}}{8\pi\left(-1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(5-z_0\right)^k z_0^{-k}}{k!}\right)}$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

We note that:

(((√(10-2√5) -2))/((√5-1)))*((2 i (sqrt(5) - 1) t + sqrt(5) - 1)/(2 (sqrt(2 (5 - sqrt(5))) - 2)))

Input:

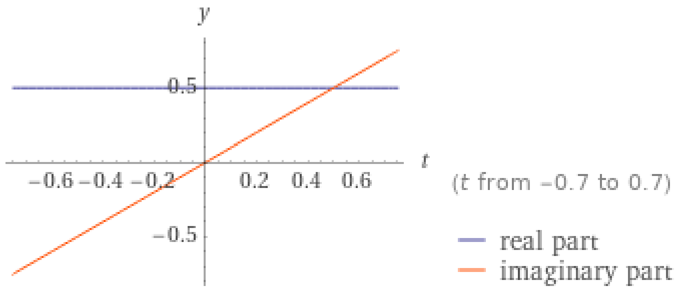
$$\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\times\frac{2\,i\left(\sqrt{5}-1\right)t+\sqrt{5}-1}{2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)}$$

i is the imaginary unit

Exact result:

$$\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(2\,i\left(\sqrt{5}-1\right)t+\sqrt{5}-1\right)}{2\left(\sqrt{5}-1\right)\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)}$$

Plot:



Alternate form assuming t>0:

$$\frac{i\sqrt{10-2\sqrt{5}}\;t}{\sqrt{2(5-\sqrt{5})}-2}-\frac{2\,i\,t}{\sqrt{2(5-\sqrt{5})}-2}+$$
$$\frac{\sqrt{5(10-2\sqrt{5})}}{2(\sqrt{5}-1)\left(\sqrt{2(5-\sqrt{5})}-2\right)}-\frac{\sqrt{10-2\sqrt{5}}}{2(\sqrt{5}-1)\left(\sqrt{2(5-\sqrt{5})}-2\right)}-$$
$$\frac{\sqrt{5}}{(\sqrt{5}-1)\left(\sqrt{2(5-\sqrt{5})}-2\right)}+\frac{1}{(\sqrt{5}-1)\left(\sqrt{2(5-\sqrt{5})}-2\right)}$$

Alternate forms:

$$\frac{1}{8}(1+\sqrt{5})\left(2\,i\sqrt{2(3-\sqrt{5})}\;t+\sqrt{5}-1\right)$$

$$\frac{1}{2}(1+2\,i\,t)$$

$$\frac{1}{2}+i\,t$$

$1/2+it$ = *real part of every nontrivial zero of the Riemann zeta function*

Derivative:

$$\frac{d}{dt}\left(\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(2\,i\,(\sqrt{5}-1)\,t+\sqrt{5}-1\right)}{(\sqrt{5}-1)\left(2\left(\sqrt{2(5-\sqrt{5})}-2\right)\right)}\right)=i$$

Indefinite integral:

$$\int \frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(2\,i\left(\sqrt{5}-1\right)t+\sqrt{5}-1\right)}{\left(\sqrt{5}-1\right)\left(2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)\right)}\,dt=\frac{t}{2}+\frac{i\,t^{2}}{2}+\text{constant}$$

And again:

(((√(10-2√5) -2))⁄((2x)))*((2 i (sqrt(5) - 1) t + sqrt(5) - 1)/(2 (sqrt(2 (5 - sqrt(5))) - 2))) = (1/2+it)

Input:

$$\frac{\sqrt{10-2\sqrt{5}}-2}{2\,x}\times\frac{2\,i\left(\sqrt{5}-1\right)t+\sqrt{5}-1}{2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)}=\frac{1}{2}+i\,t$$

i is the imaginary unit

Exact result:

$$\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(2\,i\left(\sqrt{5}-1\right)t+\sqrt{5}-1\right)}{4\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}=\frac{1}{2}+i\,t$$

Alternate form assuming t and x are real:

$$\frac{\sqrt{5}-1}{x}=2$$

Alternate form:

$$\frac{\left(\sqrt{5}-1\right)(1+2\,i\,t)}{4\,x}=\frac{1}{2}+i\,t$$

Alternate form assuming t and x are positive:

$$2\,x+1=\sqrt{5}$$

Expanded forms:

$$\frac{i\sqrt{5\left(10-2\sqrt{5}\right)}\;t}{2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}-\frac{i\sqrt{10-2\sqrt{5}}\;t}{2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}-\frac{i\sqrt{5}\;t}{\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}+\frac{i\,t}{\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}+\frac{\sqrt{5\left(10-2\sqrt{5}\right)}}{4\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}-\frac{\sqrt{10-2\sqrt{5}}}{4\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}-\frac{\sqrt{5}}{2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}+\frac{1}{2\left(\sqrt{2\left(5-\sqrt{5}\right)}-2\right)x}=\frac{1}{2}+i\,t$$

$$\frac{i\sqrt{5}\;t}{2\,x}-\frac{i\,t}{2\,x}+\frac{\sqrt{5}}{4\,x}-\frac{1}{4\,x}=\frac{1}{2}+i\,t$$

Solutions:

$$t=\frac{i}{2}\,,\quad x\neq 0$$

$$x=\frac{\sqrt{5}}{2}-\frac{1}{2}$$

Input:

$$\frac{\sqrt{5}}{2}-\frac{1}{2}$$

Decimal approximation:

0.6180339887498948482045868343656381177203091798057628621354486227

…

$0.6180339887.... = \frac{1}{\phi}$

Solution for the variable x:

$$x = \frac{-2\,i\sqrt{5}\;t+2\,i\,t-\sqrt{5}\;+1}{-2-4\,i\,t}$$

Implicit derivatives:

$$\frac{\partial x(t)}{\partial t} = \frac{2\left(-1+\sqrt{5}\;-2\,x\right)x}{\left(-1+\sqrt{5}\right)(-i+2\,t)}$$

$$\frac{\partial t(x)}{\partial x} = \frac{\left(-1+\sqrt{5}\right)(-i+2\,t)}{2\left(-1+\sqrt{5}\;-2\,x\right)x}$$

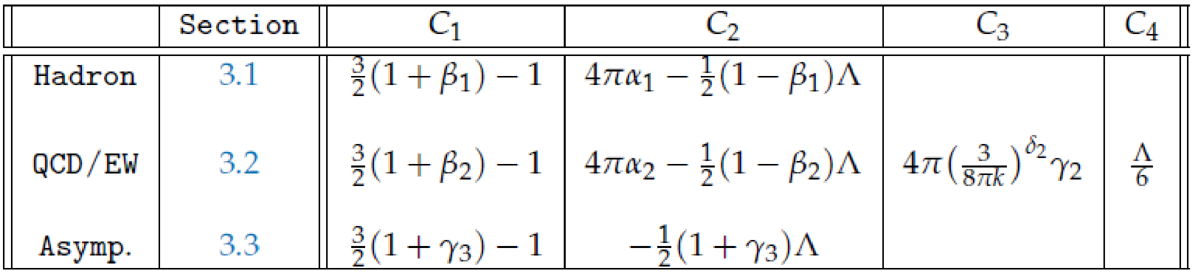
From:

Early Universe Thermodynamics and Evolution in Nonviscous and Viscous Strong and Electroweak epochs: Possible Analytical Solutions - *Abdel Nasser Tawfik and Carsten Greiner* - arXiv:2102.12477v1 [gr-qc] 24 Feb 2021

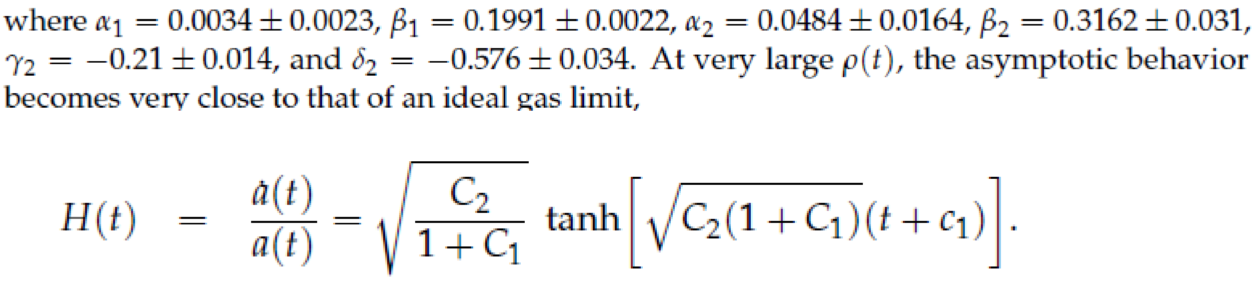
We have that:

a(t) is the dimensionless scale factor, which describes the expansion of the Universe. K characterizes elliptical, flat (Euclidean), and hyperbolic cosmic space, where k = (-1, 0,+1) stands for negative, flat, and positive curvature, respectively. Λ is the finite cosmological constant

c_1 is finite and the cosmological parameters of the hadron epoch (10^-6 – 10^-5 s)



	Section	C_1	C_2	C_3	C_4
Hadron	3.1	$\frac{3}{2}(1+\beta_1)-1$	$4\pi\alpha_1-\frac{1}{2}(1-\beta_1)\Lambda$		
QCD/EW	3.2	$\frac{3}{2}(1+\beta_2)-1$	$4\pi\alpha_2-\frac{1}{2}(1-\beta_2)\Lambda$	$4\pi\left(\frac{3}{8\pi k}\right)^{\delta_2}\gamma_2$	$\frac{\Lambda}{6}$
Asymp.	3.3	$\frac{3}{2}(1+\gamma_3)-1$	$-\frac{1}{2}(1+\gamma_3)\Lambda$		



where $\alpha_1 = 0.0034 \pm 0.0023$, $\beta_1 = 0.1991 \pm 0.0022$, $\alpha_2 = 0.0484 \pm 0.0164$, $\beta_2 = 0.3162 \pm 0.031$, $\gamma_2 = -0.21 \pm 0.014$, and $\delta_2 = -0.576 \pm 0.034$. At very large $\rho(t)$, the asymptotic behavior becomes very close to that of an ideal gas limit,

$$H(t) = \frac{\dot{a}(t)}{a(t)} = \sqrt{\frac{C_2}{1+C_1}} \tanh\left[\sqrt{C_2(1+C_1)}(t+c_1)\right].$$

Sqrt[(4Pi*0.0034-1/2(1-0.1991)*1.1056e-52)/(((1+(3/2(1+0.1991)-1))))] tanh [sqrt((4Pi*0.0034-1/2(1-0.1991)*1.1056e-52)((1+(3/2(1+0.1991)-1)))) (1+10^-6)]

Input interpretation:

$$\sqrt{\frac{4\pi\times 0.0034-\frac{1}{2}(1-0.1991)\times 1.1056\times 10^{-52}}{1+\left(\frac{3}{2}(1+0.1991)-1\right)}}\tanh\left(\sqrt{\left(4\pi\times 0.0034-\frac{1}{2}(1-0.1991)\times 1.1056\times 10^{-52}\right)\left(1+\left(\frac{3}{2}(1+0.1991)-1\right)\right)}\left(1+\frac{1}{10^{6}}\right)\right)$$

$\tanh(x)$ is the hyperbolic tangent function

Result:

0.0416638603452674780047295342082659274362781377931846390095546286…

0.04166386

0.04166386 = x/y

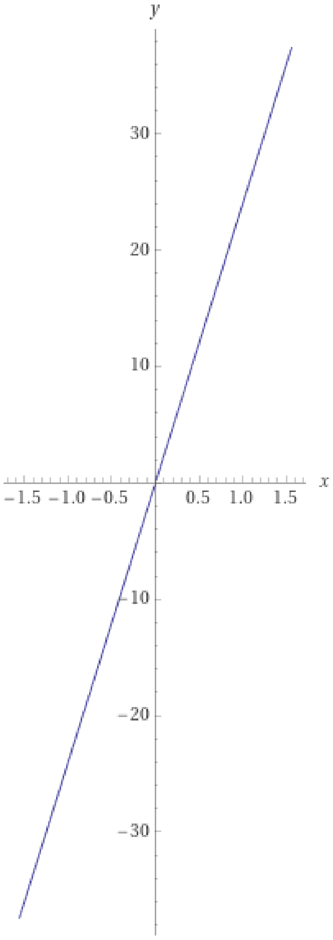
Input interpretation:

$$0.04166386=\frac{x}{y}$$

Geometric figure:

line

Implicit plot:



Alternate form:

$y = 24.0016\,x$

Alternate form assuming x and y are positive:

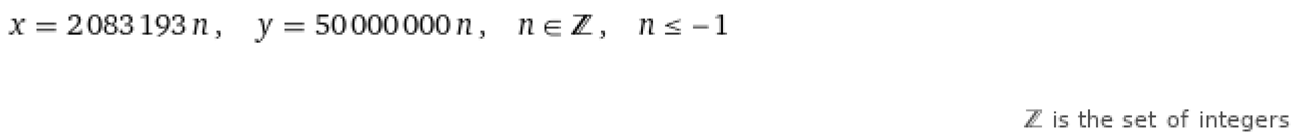
$x = 0.0416639\,y$

Solution:

$y \approx 24.0016\,x\,, \quad x \neq 0$

Integer solutions:

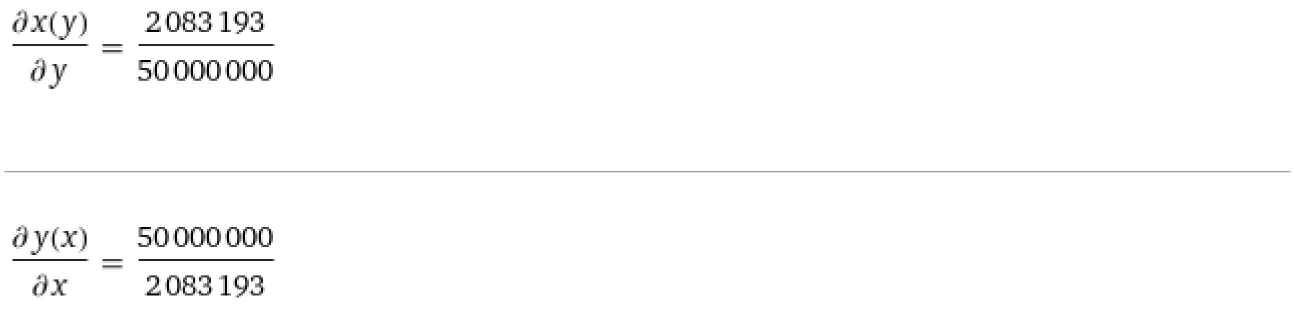
$x = 2\,083\,193\,n\,, \quad y = 50\,000\,000\,n\,, \quad n \in \mathbb{Z}\,, \quad n \geq 1$



$x = 2083193\,n, \quad y = 50000000\,n, \quad n \in \mathbb{Z}, \quad n \leq -1$

$\mathbb{Z}$ is the set of integers

Implicit derivatives:



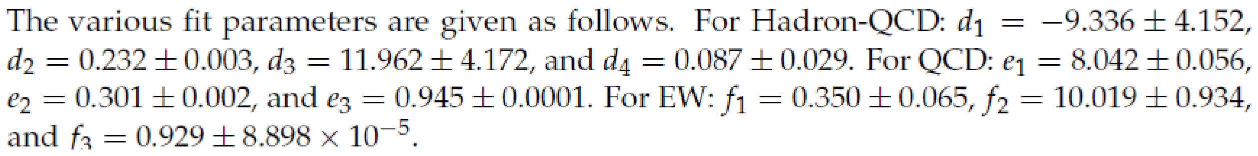
$$\frac{\partial x(y)}{\partial y} = \frac{2083193}{50000000}$$

$$\frac{\partial y(x)}{\partial x} = \frac{50000000}{2083193}$$

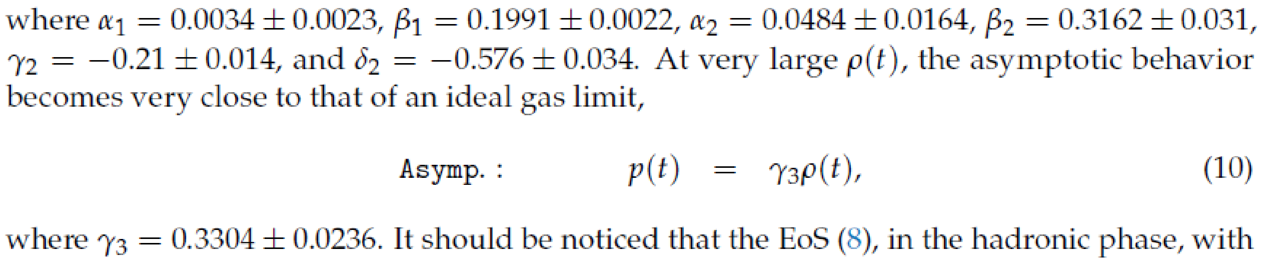
x = 1.5 and y = 24

Now, we have the following data:

$\dot{a}(t) = 1.5$; $a(t) = 24$



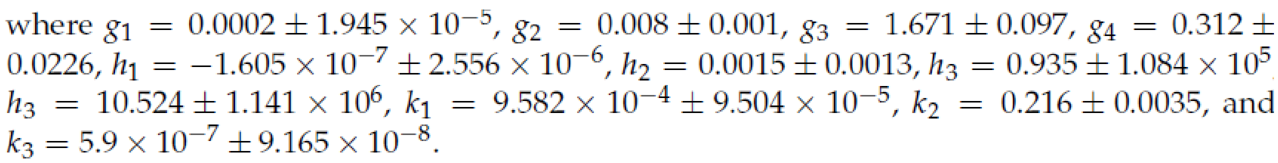
The various fit parameters are given as follows. For Hadron-QCD: $d_1 = -9.336 \pm 4.152$, $d_2 = 0.232 \pm 0.003$, $d_3 = 11.962 \pm 4.172$, and $d_4 = 0.087 \pm 0.029$. For QCD: $e_1 = 8.042 \pm 0.056$, $e_2 = 0.301 \pm 0.002$, and $e_3 = 0.945 \pm 0.0001$. For EW: $f_1 = 0.350 \pm 0.065$, $f_2 = 10.019 \pm 0.934$, and $f_3 = 0.929 \pm 8.898 \times 10^{-5}$.



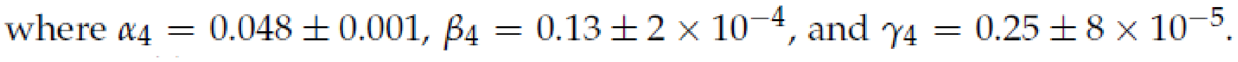
where $\alpha_1 = 0.0034 \pm 0.0023$, $\beta_1 = 0.1991 \pm 0.0022$, $\alpha_2 = 0.0484 \pm 0.0164$, $\beta_2 = 0.3162 \pm 0.031$, $\gamma_2 = -0.21 \pm 0.014$, and $\delta_2 = -0.576 \pm 0.034$. At very large $\rho(t)$, the asymptotic behavior becomes very close to that of an ideal gas limit,

$$\texttt{Asymp.}: \qquad p(t) = \gamma_3 \rho(t), \tag{10}$$

where $\gamma_3 = 0.3304 \pm 0.0236$. It should be noticed that the EoS (8), in the hadronic phase, with



where $g_1 = 0.0002 \pm 1.945 \times 10^{-5}$, $g_2 = 0.008 \pm 0.001$, $g_3 = 1.671 \pm 0.097$, $g_4 = 0.312 \pm 0.0226$, $h_1 = -1.605 \times 10^{-7} \pm 2.556 \times 10^{-6}$, $h_2 = 0.0015 \pm 0.0013$, $h_3 = 0.935 \pm 1.084 \times 10^5$ $h_3 = 10.524 \pm 1.141 \times 10^6$, $k_1 = 9.582 \times 10^{-4} \pm 9.504 \times 10^{-5}$, $k_2 = 0.216 \pm 0.0035$, and $k_3 = 5.9 \times 10^{-7} \pm 9.165 \times 10^{-8}$.



where $\alpha_4 = 0.048 \pm 0.001$, $\beta_4 = 0.13 \pm 2 \times 10^{-4}$, and $\gamma_4 = 0.25 \pm 8 \times 10^{-5}$.

$\dot{a}(t)$ = 1.5 ; $a(t)$ = 24

f_1 = 0.350 ; f_2 = 10.019 ; f_3 = 0.929 * 10^-5

k_1 = 9.582*10^-4 ; k_2 = 0.216 ; k_3 = 5.9*10^-7 ; γ_3 = 0.3304

We have that:

> For the evolution of the bulk viscous pressure, we adopt the causal evolution equation in the simplest way, i.e. linear in Π satisfying the H-theorem [18]. Accordingly, the entropy production remains nonnegative, $S^i_{;i} = \Pi^2/\zeta T \geq 0$ [48,49]). The causal transport equation of the bulk viscous pressure reads [18]
>
> $$\tau\dot{\Pi} + \Pi = -3\zeta H - \frac{\epsilon}{2}\tau\Pi\left(3H + \frac{\dot{\tau}}{\tau} - \frac{\dot{\zeta}}{\zeta} - \frac{\dot{T}}{T}\right), \tag{64}$$
>
> where ϵ is a parameter controlling the type of considered theory. $\epsilon = 1$ assures full theory, while $\epsilon = 0$ a truncated one. It is obvious that the non-causal Eckart theory can be retrieved, Eq. (46), at $\tau = 0$. In order to have a closed system from Eqs. (4), (7) and (64), we have to introduce EoS for the pressure $p(t)$, the temperature $T(t)$, bulk viscosity coefficient ζ(t), and the relaxation time $\tau(t)$, respectively, section 4.1.

the cosmic evolution, Eq. (64), can be expressed as

$$\begin{aligned}
&3\left[f_1 + 8^{-f_3} f_2\left(\frac{1}{\pi}\left[\Lambda - \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{f_3}\right]\frac{\dot{a}(t)}{a(t)} + \epsilon\frac{3\times a^{-4-3k_2}k_1}{\pi a(t)^2}\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{k_2} \\
&\log\left[\frac{k_3}{8\pi a(t)^2}\left[-\Lambda a(t)^2 + 3\left[k+\dot{a}(t)^2\right]\right]\right]\left[\frac{\Lambda a(t)^2}{(1+\gamma_3)^{-1}} - \frac{k+\dot{a}(t)^2}{(1+3\gamma_3)^{-1}} - 2a(t)\ddot{a}(t)\right]\dot{a}(t) \\
&\Bigg\{\frac{1}{a(t)} + \frac{2k_2[k+\dot{a}(t)-a(t)\ddot{a}(t)]}{\Lambda a(t)^3 - 3a(t)[k+\dot{a}(t)^2]} + \frac{2[k+\dot{a}(t)-a(t)\ddot{a}(t)]}{\Lambda a(t)^2 - 3[a(t)+\dot{a}(t)*2]}\frac{1}{a(t)\log\left[\frac{k_3\left[-\Lambda a(t)^2+3\left[k+\dot{a}(t)^2\right]\right]}{8\pi a(t)^2}\right]} - \\
&\frac{k+\dot{a}(t)^2 - a(t)\ddot{a}(t)}{\Lambda a(t)^2 - 3[k+\dot{a}(t)^2]}\frac{1}{a(t)}\left[\frac{2f_2 f_3\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{f_3}}{8^{f_3}f_1 + f_2\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{f_3}} - \frac{2\beta_4\gamma_4\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{\gamma_4}}{8^{\gamma_4}\alpha_4 + \beta_4\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{\gamma_4}}\right]\Bigg\} + \\
&\frac{8^{-1-k_2}}{\pi a(t)^3}\Bigg\{\frac{8^{k_2}\Lambda a(t)^3}{(1+\gamma_3)^{-1}} + \frac{2k_1\dot{a}(t)}{(1+3\gamma_3)^{-1}}\log\left[\frac{k_3}{8\pi a(t)^2}\left[-\Lambda a(t)^2 + 3\left[k+\dot{a}(t)^2\right]\right]\right]\frac{\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{k_2}}{[k+\dot{a}(t)^2]^{-1}} - \\
&\left[\frac{8^{k_2}k}{(1+3\gamma_3)^{-1}} + \frac{8^{k_2}\dot{a}(t)^2}{(1+3\gamma_3)^{-1}} + 6k_1\gamma_3\log\left[\frac{k_3\left[-\Lambda a(t)^2+3\left[k+\dot{a}(t)^2\right]\right]}{8\pi a(t)^2}\right]\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{k_2}\dot{a}(t)\ddot{a}(t)\right]a(t) - \\
&2\left[8^{k_2}\ddot{a}(t) + k_1\log\left[\frac{k_3\left[-\Lambda a(t)^2+3\left[k+\dot{a}(t)^2\right]\right]}{8\pi a(t)^2}\right]\left(\frac{1}{\pi}\left[-\Lambda + \frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{k_2}\dddot{a}(t)\right]a(t)^2\Bigg\} = 0.
\end{aligned} \tag{A.11}$$

From:

$$3\left[f_1+8^{-f_3}f_2\left(\frac{1}{\pi}\left[\Lambda-\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{f_3}\right]\frac{\dot{a}(t)}{a(t)}+\epsilon\frac{3\times a^{-4-3k_2}k_1}{\pi a(t)^2}\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{k_2}$$

$$\log\left[\frac{k_3}{8\pi a(t)^2}\left[-\Lambda a(t)^2+3\left[k+\dot{a}(t)^2\right]\right]\right]\left[\frac{\Lambda a(t)^2}{(1+\gamma_3)^{-1}}-\frac{k+\dot{a}(t)^2}{(1+3\gamma_3)^{-1}}-2a(t)\ddot{a}(t)\right]\dot{a}(t)$$

For $\dot{a}(t)$ = 1.5 ; $a(t)$ = 24 f_1 = 0.350 ; f_2 = 10.019 ; f_3 = 0.929 * 10^-5 ; ϵ = 1

k_1 = 9.582*10^-4 ; k_2 = 0.216 ; k_3 = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

3((0.350+8^-(0.929*10^-5)*10.019(((1/Pi((1.1056e-52-((1+1.5^2)/(24^2))))))))^(0.929*10^-5))*(1.5/24)+(3*24^(-4-3*0.216)*9.582*10^-4)/(Pi*24^2)*(((1/Pi((-1.1056e-52+((1+1.5^2)/(24^2)))))))^0.216

Input interpretation:

$$3\left(0.35+8^{-0.929\times 10^{-5}}\times 10.019\left(\frac{1}{\pi}\left(1.1056\times 10^{-52}-\frac{1+1.5^2}{24^2}\right)\right)\right)^{0.929\times 10^{-5}}\times\frac{1.5}{24}+\frac{3\times 24^{-4-3\times 0.216}\times 9.582\times 10^{-4}}{\pi\times 24^2}\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.216}$$

Result:

0.18749807941487656685322511983956584858971972284217660598713859 67…

0.187498079….

0.1874980794*(((ln((0.216/(8Pi*24^2)(-1.1056e-52*24^2+3(1+1.5^2)))) (((((1.1056e-52*24^2)/(1+0.3304)^-1)-((1+1.5^2)/(1+3*0.3304)^-1)-2*24*1.5)))*1.5)))

Input interpretation:

$$0.1874980794\left(\log\left(\frac{0.216}{8\,\pi\times 24^2}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)\right)\left(\frac{1.1056\times 10^{-52}\times 24^2}{\frac{1}{1+0.3304}}-\frac{1+1.5^2}{\frac{1}{1+3\times 0.3304}}-2\times 24\times 1.5\right)\times 1.5\right)$$

log(x) is the natural logarithm

Result:

194.99795550644644486887481901816329055822350054356586256076058665…

194.99795550644…..

For $\dot{a}(t)$ = 1.5 ; $a(t)$ = 24 f$_1$ = 0.350 ; f$_2$ = 10.019 ; f$_3$ = 0.929 * 10^-5 ; ϵ = 1

k$_1$ = 9.582*10^-4 ; k$_2$ = 0.216 ; k$_3$ = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

From:

$$\frac{1}{a(t)}+\frac{2k_2[k+\dot{a}(t)-a(t)\ddot{a}(t)]}{\Lambda a(t)^3-3a(t)[k+\dot{a}(t)^2]}+\frac{2[k+\dot{a}(t)-a(t)\ddot{a}(t)]}{\Lambda a(t)^2-3[a(t)+\dot{a}(t)*2]}\frac{1}{a(t)\log\left[\frac{k_3[-\Lambda a(t)^2+3[k+\dot{a}(t)^2]]}{8\pi a(t)^2}\right]}-$$

1/24+(2*0.216(1+1.5-24*1.5))/(1.1056e-52*24^3-3*24(1+1.5^2))+(2(1+1.5-24*1.5))/(1.1056e-52*24^2-3(24+1.5*2))*1/(24 ln((((((5.9*10^-7(-1.1056e-52*24^2+3(1+1.5^2))))/(8Pi*24^2))))))

Input interpretation:

$$\frac{1}{24}+\frac{2\times 0.216\,(1+1.5-24\times 1.5)}{1.1056\times 10^{-52}\times 24^3-3\times 24\left(1+1.5^2\right)}+\frac{2\,(1+1.5-24\times 1.5)}{1.1056\times 10^{-52}\times 24^2-3\,(24+1.5\times 2)}\times\frac{1}{24\log\left(\frac{5.9\times 10^{-7}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)}{8\,\pi\times 24^2}\right)}$$

$\log(x)$ is the natural logarithm

Result:

0.1019206199390133935589220557510078715094913042988187784382101635

…

0.101920619939….

From:

$$\frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{\Lambda a(t)^2-3[k+\dot{a}(t)^2]}\,\frac{1}{a(t)}$$

(1+1.5^2-24*1.5) / (1.1056e-52*24^2-3(1+1.5^2))*1/24

Input interpretation:

$$\frac{1+1.5^2-24\times 1.5}{1.1056\times 10^{-52}\times 24^2-3\left(1+1.5^2\right)}\times\frac{1}{24}$$

Result:

0.1399572649572649572649572649572649572649572649572658714020775805

…

0.1399572649572….

1/24+(2*0.216(1+1.5-24*1.5))/(1.1056e-52*24^3-3*24(1+1.5^2))+(2(1+1.5-24*1.5))/(1.1056e-52*24^2-3(24+1.5*2))*1/(24 ln((((((5.9*10^-7(-1.1056e-52*24^2+3(1+1.5^2))))/(8Pi*24^2))))))-0.1399572649572

Input interpretation:

$$\frac{1}{24}+\frac{2\times 0.216\,(1+1.5-24\times 1.5)}{1.1056\times 10^{-52}\times 24^3-3\times 24\left(1+1.5^2\right)}+\frac{2\,(1+1.5-24\times 1.5)}{1.1056\times 10^{-52}\times 24^2-3\,(24+1.5\times 2)}\times\frac{1}{24\log\left(\frac{5.9\times 10^{-7}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)}{8\pi\times 24^2}\right)}-0.1399572649572$$

log(*x*) is the natural logarithm

Result:

−0.038036645018186606441077944248992128490508695701181221561789836

...

-0.038036645….

From:

$$\left[\frac{2f_2f_3\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{f_3}}{8^{f_3}f_1+f_2\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{f_3}}-\frac{2\beta_4\gamma_4\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{\gamma_4}}{8^{\gamma_4}\alpha_4+\beta_4\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{\gamma_4}}\right]$$

For $\dot{a}(t)$ = 1.5 ; $a(t)$ = 24 f$_1$ = 0.350 ; f$_2$ = 10.019 ; f$_3$ = 0.929 * 10^-5 ; ϵ = 1

k$_1$ = 9.582*10^-4 ; k$_2$ = 0.216 ; k$_3$ = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

where $\alpha_4 = 0.048 \pm 0.001$, $\beta_4 = 0.13 \pm 2\times 10^{-4}$, and $\gamma_4 = 0.25 \pm 8\times 10^{-5}$.

[2(10.019*0.929*10^-5)((((1/Pi)(((-1.1056e-52+(1+1.5^2)/(24^2)))))))^(0.929e-5)]/[8^(0.929e-5)*0.350+10.019((((1/Pi)(((-1.1056e-52+(1+1.5^2)/(24^2)))))))^(0.929e-5)]

Input interpretation:

$$\frac{2\left(10.019\times 0.929\times 10^{-5}\right)\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.929\times 10^{-5}}}{8^{0.929\times 10^{-5}}\times 0.35+10.019\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.929\times 10^{-5}}}$$

Result:

0.0000179527948257837986413323217485624379775722489287383060652623 …

0.0000179527948…..

[2(0.13*0.25*10^-5)((((1/Pi)(((-1.1056e-52+(1+1.5^2)/(24^2)))))))^(0.25e-5)]/[8^(0.25e-5)*0.048+0.13e-4((((1/Pi)(((-1.1056e-52+(1+1.5^2)/(24^2)))))))^(0.25e-5)]

Input interpretation:

$$\frac{2\left(0.13\times 0.25\times 10^{-5}\right)\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.25\times 10^{-5}}}{8^{0.25\times 10^{-5}}\times 0.048+0.13\times 10^{-4}\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.25\times 10^{-5}}}$$

Result:

0.0000135377158519713886040025010883250391484082912315871401556542 …

0.0000135377158….

[2(10.019*0.929*10^-5)((((1/Pi)(((-1.1056e-52+(1+1.5^2)/(24^2))))))^(0.929e-5)]/[8^(0.929e-5)*0.350+10.019((((1/Pi)(((-1.1056e-52+(1+1.5^2)/(24^2))))))^(0.929e-5)]-0.0000135377158

Input interpretation:

$$\frac{2\left(10.019\times 0.929\times 10^{-5}\right)\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.929\times 10^{-5}}}{8^{0.929\times 10^{-5}}\times 0.35+10.019\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.929\times 10^{-5}}}-0.0000135377158$$

Result:

$4.41508\ldots\times 10^{-6}$

$4.41508\ldots.*10^{-6}$

where $\alpha_4 = 0.048 \pm 0.001$, $\beta_4 = 0.13 \pm 2\times 10^{-4}$, and $\gamma_4 = 0.25 \pm 8\times 10^{-5}$.

For $\dot{a}(t)$ = 1.5 ; $a(t)$ = 24 f_1 = 0.350 ; f_2 = 10.019 ; f_3 = 0.929 * 10^-5 ; ϵ = 1

k_1 = 9.582*10^-4 ; k_2 = 0.216 ; k_3 = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

$$\frac{8^{-1-k_2}}{\pi a(t)^3}$$

8^(-1-0.216) / (Pi*24^3)

Input:

$$\frac{8^{-1-0.216}}{\pi\times 24^3}$$

Result:

$1.83679\ldots\times 10^{-6}$

$1.83679\ldots.*10^{-6}$

$$\frac{8^{k_2}\Lambda a(t)^3}{(1+\gamma_3)^{-1}} + \frac{2k_1\dot a(t)}{(1+3\gamma_3)^{-1}} \log\left[\frac{k_3}{8\pi a(t)^2}\left[-\Lambda a(t)^2+3\left[k+\dot a(t)^2\right]\right]\right] \frac{\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot a(t)^2}{a(t)^2}\right]\right)^{k_2}}{\left[k+\dot a(t)^2\right]^{-1}}$$

(8^0.216 * -1.1056e-52*24^3)1/(1+0.3304)+(2*9.582e-4*1.5)1/(1+3*0.3304) (ln((((5.9e-7*1/(8Pi*24^2)(((-1.1056e-52*24^2+3(1+1.5^2))))((1/(1+1.5^2)^-1)))))))(((1/Pi(-1.1056e-52+(1+1.5^2)/(24^2)))))^0.216

Input interpretation:

$$\left(8^{0.216}\left(-1.1056\times 10^{-52}\right)\times 24^3\right)\times\frac{1}{1+0.3304}+\left(2\times 9.582\times 10^{-4}\times 1.5\right)\times\frac{1}{1+3\times 0.3304}\left(\log\left(5.9\times 10^{-7}\times\frac{1}{8\,\pi\times 24^2}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)\times\frac{1}{\frac{1}{1+1.5^2}}\right)\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.216}\right)$$

$\log(x)$ is the natural logarithm

Result:

−0.007541513555752608753195212947240802891179343744268552306032204
…

-0.007541513555…..

From:

$$\left[\frac{8^{k_2}k}{(1+3\gamma_3)^{-1}}+\frac{8^{k_2}\dot a(t)^2}{(1+3\gamma_3)^{-1}}+6k_1\gamma_3\log\left[\frac{k_3\left[-\Lambda a(t)^2+3\left[k+\dot a(t)^2\right]\right]}{8\pi a(t)^2}\right]\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot a(t)^2}{a(t)^2}\right]\right)^{k_2}\dot a(t)\ddot a(t)\right]a(t)$$

For $\dot a(t)$ = 1.5 ; $a(t)$ = 24 f_1 = 0.350 ; f_2 = 10.019 ; f_3 = 0.929 * 10^-5 ; ϵ = 1

k_1 = 9.582*10^-4 ; k_2 = 0.216 ; k_3 = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

[1/(1+3*0.3304)*8^0.216+1/(1+3*0.3304)*8^0.216*1.5^2+6*(9.582e-4)*0.3304* ln((((((5.9e-7*1/(8Pi*24^2)(((-1.1056e-52*24^2+3(1+1.5^2)))))))))) (((1/Pi(-1.1056e-52+(1+1.5^2)/(24^2)))))^0.216)*1.5^2]*24

Input interpretation:

$$\Biggl(\frac{1}{1+3\times 0.3304}\times 8^{0.216}+\frac{1}{1+3\times 0.3304}\times 8^{0.216}\times 1.5^2+6\times 9.582\times 10^{-4}\times 0.3304 \log\biggl(\biggl(5.9\times 10^{-7}\times\frac{1}{8\pi\times 24^2}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)\biggr) \left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.216}\biggr)\times 1.5^2\Biggr)\times 24$$

log(x) is the natural logarithm

Result:

59.0224…

59.0224….

From:

$$2\left[8^{k_2}\ddot{a}(t)+k_1\log\left[\frac{k_3\left[-\Lambda a(t)^2+3\left[k+\dot{a}(t)^2\right]\right]}{8\pi a(t)^2}\right]\left(\frac{1}{\pi}\left[-\Lambda+\frac{k+\dot{a}(t)^2}{a(t)^2}\right]\right)^{k_2}\dddot{a}(t)\right]a(t)^2$$

For $\dot{a}(t)$ = 1.5 ; $a(t)$ = 24 f_1 = 0.350 ; f_2 = 10.019 ; f_3 = 0.929 * 10^-5 ; ϵ = 1

k_1 = 9.582*10^-4 ; k_2 = 0.216 ; k_3 = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

2[8^0.216*1.5+9.582e-4 ln(((((5.9e-7*1/(8Pi*24^2)(((-1.1056e-52*24^2+3(1+1.5^2)))))))))(((1/Pi(-1.1056e-52+(1+1.5^2)/(24^2)))))^0.216)*1.5]*24^2

Input interpretation:

$$2\left(8^{0.216}\times 1.5+9.582\times 10^{-4}\log\left(5.9\times 10^{-7}\times \frac{1}{8\,\pi\times 24^2}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)\right)\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{0.216}\times 1.5\right)\times 24^2$$

log(x) is the natural logarithm

Result:

2698.62…

2698.62….

In conclusion, we obtain:

194.99795550644(0.101920619939-0.1399572649572*4.41508*10^-6)+1.83679*10^-6*[-0.007541513555-59.0224-2698.62]

Input interpretation:

$$194.99795550644\left(0.101920619939+4.41508\times 10^{-6}\times(-0.1399572649572)\right)+1.83679\times 10^{-6}\left(-0.007541513555-59.0224-2698.62\right)$$

Result:

19.869126794589502828990663485641330 56

19.86912679…. final result

From which:

1/6((194.99795550644(0.101920619939-0.1399572649572*4.41508*10^-6)+1.83679*10^-6*[-0.007541513555-59.0224-2698.62])-10)

Input interpretation:

$$\frac{1}{6}\left(\left(194.99795550644\left(0.101920619939+4.41508\times10^{-6}\times(-0.1399572649572)\right)+1.83679\times10^{-6}\left(-0.007541513555-59.0224-2698.62\right)\right)-10\right)$$

Result:

1.6448544657649171381651105809402217 6

$1.6448544657\ldots. \approx \zeta(2)=\frac{\pi^2}{6} = 1.644934\ldots$

(194.99795550644(0.101920619939-0.1399572649572*4.41508*10^-6)+ 1.83679*10^-6*[-0.007541513555-59.0224-2698.62])^1/(2Pi*0.989117352243)

Where 0.989117352243 is a result very near to the value of the following Rogers-Ramanujan continued fraction:

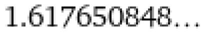
$$\frac{e^{-\frac{\pi}{\sqrt{5}}}}{\frac{\sqrt{5}}{1+\sqrt[5]{\sqrt{\varphi^5\sqrt[4]{5^3}}-1}}-\varphi+1}=1-\frac{e^{-\pi\sqrt{5}}}{1+\frac{e^{-2\pi\sqrt{5}}}{1+\frac{e^{-3\pi\sqrt{5}}}{1+\frac{e^{-4\pi\sqrt{5}}}{1+\ldots}}}}\approx 0.9991104684$$

and to the Omega mesons ($\omega/\omega_3 \mid 5+3 \mid m_{u/d} = 255 - 390 \mid 0.988 - 1.18$) Regge slope value (0.988) connected to the dilaton scalar field 0.989117352243 = ϕ

Input interpretation:

$$\left(194.99795550644\left(0.101920619939+4.41508\times10^{-6}\times(-0.1399572649572)\right)+1.83679\times10^{-6}\left(-0.007541513555-59.0224-2698.62\right)\right)^{\wedge}\left(\frac{1}{2\,\pi\times0.989117352243}\right)$$

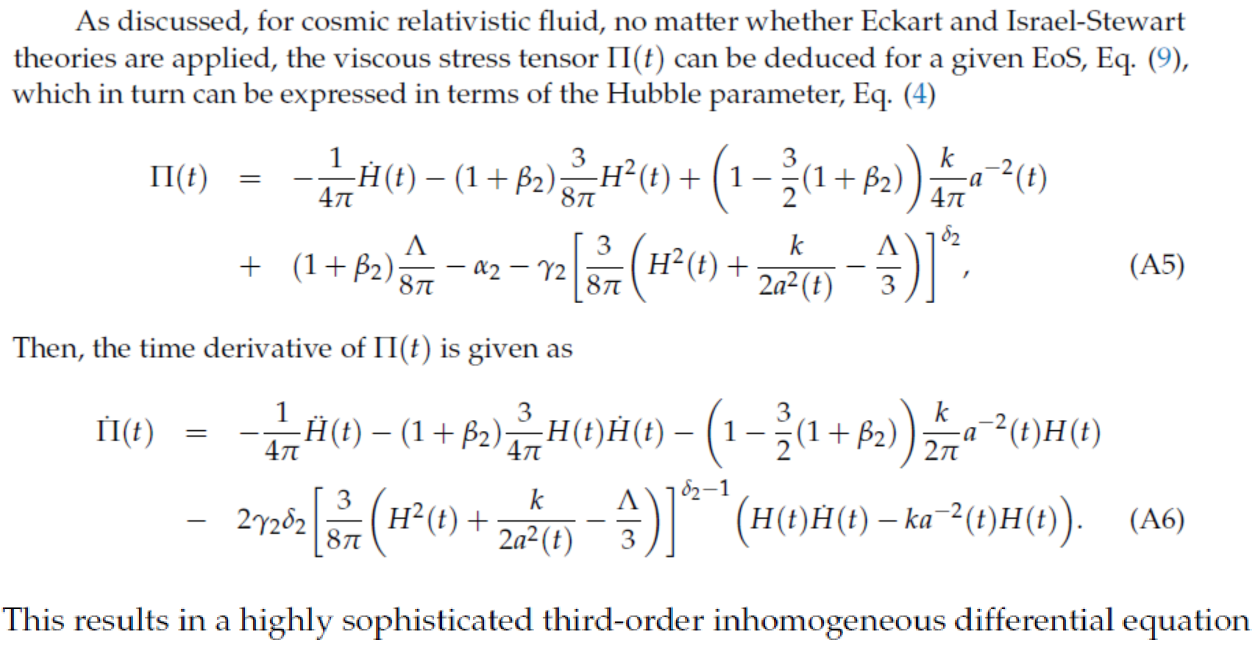
Result:



1.617650848…

1.617650848…. result that is a very good approximation to the value of the golden ratio 1.618033988749...

From:



As discussed, for cosmic relativistic fluid, no matter whether Eckart and Israel-Stewart theories are applied, the viscous stress tensor $\Pi(t)$ can be deduced for a given EoS, Eq. (9), which in turn can be expressed in terms of the Hubble parameter, Eq. (4)

$$\begin{aligned}\Pi(t) &= -\frac{1}{4\pi}\dot{H}(t) - (1+\beta_2)\frac{3}{8\pi}H^2(t) + \left(1-\frac{3}{2}(1+\beta_2)\right)\frac{k}{4\pi}a^{-2}(t) \\ &+ (1+\beta_2)\frac{\Lambda}{8\pi} - \alpha_2 - \gamma_2\left[\frac{3}{8\pi}\left(H^2(t)+\frac{k}{2a^2(t)}-\frac{\Lambda}{3}\right)\right]^{\delta_2}, \qquad \text{(A5)}\end{aligned}$$

Then, the time derivative of $\Pi(t)$ is given as

$$\begin{aligned}\dot{\Pi}(t) &= -\frac{1}{4\pi}\ddot{H}(t) - (1+\beta_2)\frac{3}{4\pi}H(t)\dot{H}(t) - \left(1-\frac{3}{2}(1+\beta_2)\right)\frac{k}{2\pi}a^{-2}(t)H(t) \\ &- 2\gamma_2\delta_2\left[\frac{3}{8\pi}\left(H^2(t)+\frac{k}{2a^2(t)}-\frac{\Lambda}{3}\right)\right]^{\delta_2-1}\left(H(t)\dot{H}(t) - ka^{-2}(t)H(t)\right). \qquad \text{(A6)}\end{aligned}$$

This results in a highly sophisticated third-order inhomogeneous differential equation

$$
\begin{aligned}
&-\alpha_2 - 8^{-\delta_2}\gamma_2\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\delta_2} + \frac{\Lambda a(t)^2 - 3[k+\dot{a}(t)^2]}{8\pi a(t)^2}(1+\beta_2) + \frac{k+\dot{a}(t)\ddot{a}(t)}{4\pi a(t)^2} + \\
&3\left[d_1 - \frac{d_2\Lambda}{8\pi} + \frac{3d_2}{8\pi}\frac{k+\dot{a}(t)^2}{a(T)^2} + 8^{-d_4}d_3\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{d_4}\right]\frac{\dot{a}(t)}{a(t)} + \\
&\epsilon\frac{3\times 2^{-4-3\delta_2}}{\pi a(t)^3}\left[g_1 + g_2 e^{-8^{g_4}g_3\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{g_4}}\right]\left[-8^{\delta_2}\frac{k+\dot{a}(t)^2}{(1+3\beta_2)^{-1}} + a(t)^2\left[\frac{1+\beta_2}{8^{-\delta_2}}\Lambda - \right.\right. \\
&\left.\left. 8\pi\left(8^{\delta_2}\alpha_2 + \gamma_2\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{\delta_2}\right)\right] - 2^{1+3\delta_2}a(t)\ddot{a}(t)\right]\left\{1 - \frac{k+\dot{a}(t)^2 - a(t)\ddot{a}(t)}{\Lambda a(t)^2 - 3[k+\dot{a}(t)^2]}\right. \\
&\left[\frac{2^{1-3g_4}g_2g_3g_4\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{g_4}}{g_2 + g_1 e^{8^{-g_4}g_3\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{g_4}}} - \frac{2\beta_4\gamma_4\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{\gamma_4}}{8^{\gamma_4}\alpha_4 + \beta_4\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{\gamma_4}} - \right. \\
&\left.\left.\frac{2\left[\frac{3\times 8^{d_4}d_2}{[k+\dot{a}(t)^2]^{-1}} + a(t)^2\left(-8^{d_4}d_2\Lambda + 8d_3d_4\pi\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{d_4}\right)\right]}{\left[\frac{3\times 8^{d_4}d_2}{[k+\dot{a}(t)^2]^{-1}} + a(t)^2\left(8^{1+d_4}d_1\pi - 8^{d_4}d_2\Lambda + 8d_3\pi\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{d_4}\right)\right]}\right]\right\}\dot{a}(t) + \\
&\frac{g_1 + g_2 e^{-8^{g_4}g_3\left[-\frac{\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(T)^2}}{\pi}\right]^{g_4}}}{4\pi a(t)^3\dot{a}(t)^2}\left\{\frac{k+\dot{a}(t)^2 - a(t)\ddot{a}(t)}{[4\dot{a}(t)^3]^{-1}} + \frac{k+\dot{a}(t)^2 - a(t)\ddot{a}(t)}{[3\beta_2\dot{a}(t)^3]^{-1}} + \right. \\
&\frac{k+\dot{a}(t)^2 - a(t)\ddot{a}(t)}{[2^{\delta_2}8^{1-\delta_2}\gamma_2\delta_2\dot{a}(t)^3]^{-1}}\left[\frac{-\frac{\Lambda}{3} + \frac{k+\dot{a}(t)^2}{a(T)^2}}{\pi}\right]^{\delta_2-1} - \frac{k+\dot{a}(t)^2 - a(t)\ddot{a}(t)}{[a(t)\dot{a}(t)\ddot{a}(t)]^{-1}} + \\
&\left.\left[3\dot{a}(t)^4 + \dot{a}(t)^2[3k - 5a(t)\ddot{a}(t)] + \frac{a(t)\ddot{a}(t) - k}{[a(t)\ddot{a}(t)]^{-1}} + a(t)^2\dot{a}(t)\dddot{a}(t)\right]\dot{a}(t)\right\} = 0,
\end{aligned} \tag{A7}
$$

for which the analytical solution a very challenging task.

Thence, we have:

$\dot{a}(t) = 1.5$; $a(t) = 24$

The various fit parameters are given as follows. For Hadron-QCD: $d_1 = -9.336 \pm 4.152$, $d_2 = 0.232 \pm 0.003$, $d_3 = 11.962 \pm 4.172$, and $d_4 = 0.087 \pm 0.029$. For QCD: $e_1 = 8.042 \pm 0.056$, $e_2 = 0.301 \pm 0.002$, and $e_3 = 0.945 \pm 0.0001$. For EW: $f_1 = 0.350 \pm 0.065$, $f_2 = 10.019 \pm 0.934$, and $f_3 = 0.929 \pm 8.898 \times 10^{-5}$.

where $\alpha_1 = 0.0034 \pm 0.0023$, $\beta_1 = 0.1991 \pm 0.0022$, $\alpha_2 = 0.0484 \pm 0.0164$, $\beta_2 = 0.3162 \pm 0.031$, $\gamma_2 = -0.21 \pm 0.014$, and $\delta_2 = -0.576 \pm 0.034$. At very large $\rho(t)$, the asymptotic behavior becomes very close to that of an ideal gas limit,

$$\texttt{Asymp.}: \qquad p(t) = \gamma_3\rho(t), \tag{10}$$

where $\gamma_3 = 0.3304 \pm 0.0236$. It should be noticed that the EoS (8), in the hadronic phase, with where $g_1 = 0.0002 \pm 1.945 \times 10^{-5}$, $g_2 = 0.008 \pm 0.001$, $g_3 = 1.671 \pm 0.097$, $g_4 = 0.312 \pm 0.0226$, $h_1 = -1.605 \times 10^{-7} \pm 2.556 \times 10^{-6}$, $h_2 = 0.0015 \pm 0.0013$, $h_3 = 0.935 \pm 1.084 \times 10^{5}$ $h_3 = 10.524 \pm 1.141 \times 10^{6}$, $k_1 = 9.582 \times 10^{-4} \pm 9.504 \times 10^{-5}$, $k_2 = 0.216 \pm 0.0035$, and $k_3 = 5.9 \times 10^{-7} \pm 9.165 \times 10^{-8}$.

where $\alpha_4 = 0.048 \pm 0.001$, $\beta_4 = 0.13 \pm 2 \times 10^{-4}$, and $\gamma_4 = 0.25 \pm 8 \times 10^{-5}$.

For $\dot{a}(t) = 1.5$; $a(t) = 24$ $f_1 = 0.350$; $f_2 = 10.019$; $f_3 = 0.929 * 10^{\wedge}{-5}$; $\epsilon = 1$

$k_1 = 9.582*10^{\wedge}{-4}$; $k_2 = 0.216$; $k_3 = 5.9*10^{\wedge}{-7}$; $\gamma_3 = 0.3304$; $\Lambda = 1.1056e\text{-}52$

From:

$$-\alpha_2 - 8^{-\delta_2}\gamma_2\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2} + \frac{\Lambda a(t)^2 - 3[k+\dot{a}(t)^2]}{8\pi a(t)^2}(1+\beta_2) + \frac{k+\dot{a}(t)\ddot{a}(t)}{4\pi a(t)^2} +$$
$$3\left[d_1 - \frac{d_2\Lambda}{8\pi} + \frac{3d_2}{8\pi}\frac{k+\dot{a}(t)^2}{a(T)^2} + 8^{-d_4}d_3\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{d_4}\right]\frac{\dot{a}(t)}{a(t)} +$$

-0.0484-8^0.576 * (-0.21) * 1/[-1/Pi((1.1056e-52-3((1+1.5^2)/(24^2))))]^(0.576) + (1/(8Pi*24^2)) * ((1.1056e-52)*24^2-3(1+1.5^2)) (1+0.3162) + (1/(4Pi*24^2))*(1+1.5*1.5)

Input interpretation:

$$-0.0484 - 8^{0.576} \times (-0.21) \times \frac{1}{\left(-\frac{1.1056\times10^{-52} - 3\times\frac{1+1.5^2}{24^2}}{\pi}\right)^{0.576}} +$$
$$\frac{1}{8\,\pi\times24^2}\left(1.1056\times10^{-52}\times24^2 - 3\left(1+1.5^2\right)\right)(1+0.3162) +$$
$$\frac{1}{4\,\pi\times24^2}(1+1.5\times1.5)$$

Result:

14.0471…

14.0471….

14.0471+3((-9.336-(1/(8Pi))*(0.232*1.1056e-52)+(1/(8Pi*24^2))*(3*0.232(1+1.5^2))+1/8^(0.087) * 11.962(-1/Pi((1.1056e-52-3((1+1.5^2)/(24^2)))))^(0.087)))*(1.5/24)

Input interpretation:

$$14.0471+3\left(-9.336-\frac{1}{8\,\pi}\left(0.232\times 1.1056\times 10^{-52}\right)+\frac{1}{8\,\pi\times 24^2}\left(3\times 0.232\left(1+1.5^2\right)\right)+\frac{1}{8^{0.087}}\times 11.962\left(-\frac{1.1056\times 10^{-52}-3\times\frac{1+1.5^2}{24^2}}{\pi}\right)^{0.087}\right)\times\frac{1.5}{24}$$

Result:

13.4848…

13.4848

From:

$$\epsilon\frac{3\times 2^{-4-3\delta_2}}{\pi a(t)^3}\left[g_1+g_2 e^{-8^{g_4}g_3\left[-\frac{1}{\pi}\left(\Lambda-\frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{g_4}}\right]\left[-8^{\delta_2}\frac{k+\dot{a}(t)^2}{(1+3\beta_2)^{-1}}+a(t)^2\left[\frac{1+\beta_2}{8^{-\delta_2}}\Lambda-8\pi\left(8^{\delta_2}\alpha_2+\gamma_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{\delta_2}\right)\right]-2^{1+3\delta_2}a(t)\ddot{a}(t)\right]$$

[-8^(-0.576)*(1/(1+3*0.3162)^-1)(1+1.5^2)+24^2*((1/(8^0.576))((1+0.3162)*1.1056e-52)-8Pi((8^(-0.576))*0.0484-0.21((1/Pi((-1.1056e-52+3((1+1.5^2)/(24^2)))))^(-0.576))))-(2^(1-3*0.576))*24*1.5]

Input interpretation:

$$-\frac{\frac{1}{\frac{1}{1+3\times 0.3162}}\left(1+1.5^2\right)}{8^{0.576}}+24^2\left(\frac{1}{8^{0.576}}\left((1+0.3162)\times 1.1056\times 10^{-52}\right)-8\,\pi\left(\frac{0.0484}{8^{0.576}}-\frac{0.21}{\left(\frac{1}{\pi\left(-1.1056\times 10^{-52}+3\times\frac{1+1.5^2}{24^2}\right)}\right)^{0.576}}\right)\right)-2^{1-3\times 0.576}\times 24\times 1.5$$

$\pi(x)$ is the number of primes less than or equal to x

Result:

$-23.6464\ldots$

(((1/(Pi*24^3)) * (3*2^(-4-3*(-0.576))) [0.0002*10^-5+0.008*exp(-(8^0.312)*1.671((-1/Pi((1.1056e-52-3((1+1.5^2)/(24^2)))))^(0.312)))])) (-23.6464)

Input interpretation:

$$\left(\frac{1}{\pi\times 24^3}\left(3\times 2^{-4-3\times(-0.576)}\right)\left(0.0002\times 10^{-5}+0.008\exp\left(-8^{0.312}\times 1.671\left(-\frac{1.1056\times 10^{-52}-3\times\frac{1+1.5^2}{24^2}}{\pi}\right)^{0.312}\right)\right)\right)\times(-23.6464)$$

Result:

$-1.44594\ldots\times 10^{-6}$

-1.44594*10^-6

From:

$$\left\{1-\frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{\Lambda a(t)^2-3[k+\dot{a}(t)^2]}\right.$$

1-(1+1.5^2-24*1.5)/(1.1056e-52*24^2-3(1+1.5^2))

Input interpretation:

$$1-\frac{1+1.5^2-24\times 1.5}{1.1056\times 10^{-52}\times 24^2-3\left(1+1.5^2\right)}$$

Result:

$-2.358974358974358974358974358974358974358974358974380913649861932$

$\ldots$

-2.35897435….

From:

$$\left[\frac{2^{1-3g_4}g_2g_3g_4\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{g_4}}{g_2+g_1e^{8^{-g_4}g_3\left[-\frac{1}{\pi}\left(\Lambda-\frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{g_4}}}-\frac{2\beta_4\gamma_4\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{\gamma_4}}{8^{\gamma_4}\alpha_4+\beta_4\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{\gamma_4}}-\right.$$

((2^(1-3*0.312)) (0.008*1.671*0.312) (((1/Pi)((-1.1056e-52+3((1+1.5^2)/(24^2)))))^0.312))*(((1/((0.008+0.0002e-5*exp((8^(-0.312))*1.671(((-1/Pi)((1.1056e-52-3((1+1.5^2)/(24^2)))))^0.312)))))))

Input interpretation:

$$\left(2^{1-3\times 0.312}\,(0.008\times 1.671\times 0.312)\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{1+1.5^2}{24^2}\right)\right)^{0.312}\right)\times$$

$$\frac{1}{0.008+0.0002\times 10^{-5}\exp\left(\frac{1.671\left(-\frac{1.1056\times 10^{-52}-3\times\frac{1+1.5^2}{24^2}}{\pi}\right)^{0.312}}{8^{0.312}}\right)}$$

Result:

0.106808…

0.106808-((2(0.13*10^-4)(0.25*10^-5))) (((1/Pi)((-1.1056e-52+3((1+1.5^2)/(24^2)))))^(0.25e-5))*(((1/((8^(0.25e-5))*0.048+0.13e-4(((1/Pi)((-1.1056e-52+3((1+1.5^2)/(24^2)))))^(0.25e-5))))))

Input interpretation:

$$0.106808 - \left(2 \times 0.13 \times 10^{-4} \times 0.25 \times 10^{-5}\right)\left(\left(\frac{1}{\pi}\left(-1.1056 \times 10^{-52} + 3 \times \frac{1+1.5^2}{24^2}\right)\right)^{0.25 \times 10^{-5}} \times \frac{1}{8^{0.25 \times 10^{-5}} \times 0.048 + 0.13 \times 10^{-4}\left(\frac{1}{\pi}\left(-1.1056 \times 10^{-52} + 3 \times \frac{1+1.5^2}{24^2}\right)\right)^{0.25 \times 10^{-5}}}\right)$$

Result:

0.106808…

0.106808

From:

$$\frac{2\left[\frac{3\times 8^{d_4} d_2}{\left[k+\dot{a}(t)^2\right]^{-1}} + a(t)^2\left(-8^{d_4} d_2 \Lambda + 8 d_3 d_4 \pi\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{d_4}\right)\right]}{\left[\frac{3\times 8^{d_4} d_2}{\left[k+\dot{a}(t)^2\right]^{-1}} + a(t)^2\left(8^{1+d_4} d_1 \pi - 8^{d_4} d_2 \Lambda + 8 d_3 \pi\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{d_4}\right)\right]}\Bigg]\Bigg]\Bigg\}\dot{a}(t) +$$

we obtain:

$$2\left[\frac{3\times 8^{d_4} d_2}{\left[k+\dot{a}(t)^2\right]^{-1}} + a(t)^2\left(-8^{d_4} d_2 \Lambda + 8 d_3 d_4 \pi\left[\frac{1}{\pi}\left(-\Lambda + \frac{3(k+\dot{a}(t)^2)}{a(T)^2}\right)\right]^{d_4}\right)\right]$$

2 [(1/(1+1.5^2)^-1)*3*(8^0.087)*0.232+24^2(-8^(0.087))*0.232*(1.1056e-52)+8*11.962*0.087*Pi((1/Pi)((-1.1056e-52+3((1+1.5^2)/(24^2)))))^0.087]

Input interpretation:

$$2\left(\frac{1}{\frac{1}{1+1.5^2}}\times 3\times 8^{0.087}\times 0.232+24^2\left(-8^{0.087}\right)\times 0.232\times 1.1056\times 10^{-52}+ 8\times 11.962\times 0.087\,\pi\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{1+1.5^2}{24^2}\right)\right)^{0.087}\right)$$

Result:

38.6280…

38.6280…

From:

$$\left\lfloor \frac{3\times 8^{d_4} d_2}{\left[k+\dot{a}(t)^2\right]^{-1}} + a(t)^2\left(8^{1+d_4} d_1\pi - 8^{d_4} d_2 \Lambda + 8 d_3\pi\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{d_4}\right)\right\rfloor$$

38.6280 / [(1/(1+1.5^2)^-1)*3*(8^0.087)*(0.232)+24^2(8^(1+0.087))*(-9.336)*Pi-(8^(0.087))*0.232*(1.1056e-52)+8*11.962*Pi((1/Pi)((-1.1056e-52+3((1+1.5^2)/(24^2)))))^0.087]

Input interpretation:

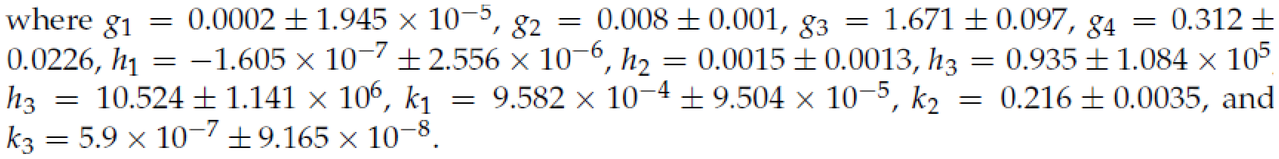
$$38.6280\Big/\left(\frac{1}{\frac{1}{1+1.5^2}}\times 3\times 8^{0.087}\times 0.232+ 24^2\times 8^{1+0.087}\times(-9.336)\,\pi-8^{0.087}\times 0.232\times 1.1056\times 10^{-52}+ 8\times 11.962\,\pi\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{1+1.5^2}{24^2}\right)\right)^{0.087}\right)$$

Result:

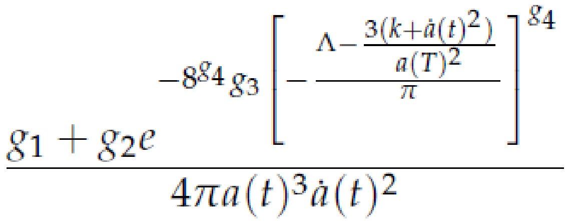
−0.000238797…

-0.000238797

1.5



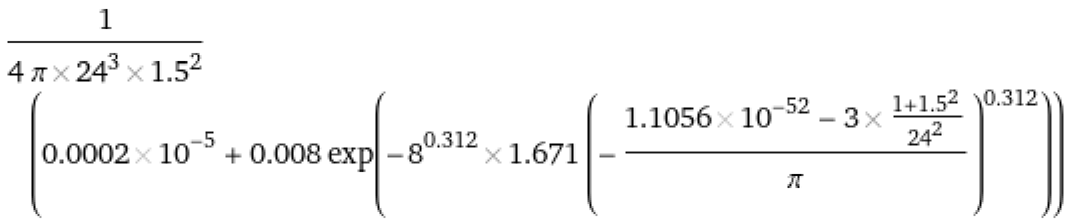
where $g_1 = 0.0002 \pm 1.945 \times 10^{-5}$, $g_2 = 0.008 \pm 0.001$, $g_3 = 1.671 \pm 0.097$, $g_4 = 0.312 \pm 0.0226$, $h_1 = -1.605 \times 10^{-7} \pm 2.556 \times 10^{-6}$, $h_2 = 0.0015 \pm 0.0013$, $h_3 = 0.935 \pm 1.084 \times 10^{5}$ $h_3 = 10.524 \pm 1.141 \times 10^{6}$, $k_1 = 9.582 \times 10^{-4} \pm 9.504 \times 10^{-5}$, $k_2 = 0.216 \pm 0.0035$, and $k_3 = 5.9 \times 10^{-7} \pm 9.165 \times 10^{-8}$.



$$\frac{g_1 + g_2 e^{-8^{g_4} g_3 \left[-\frac{\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(T)^2}}{\pi}\right]^{g_4}}}{4\pi a(t)^3 \dot{a}(t)^2}$$

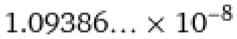
(1/(4Pi*24^3*1.5^2)) (0.0002e-5+0.008*exp((((-8^(0.312)*1.671((-1/Pi((1.1056e-52-3((1+1.5^2)/(24^2)))))^0.312))))

Input interpretation:



$$\frac{1}{4\,\pi\times 24^3\times 1.5^2}\left(0.0002\times 10^{-5}+0.008\exp\left(-8^{0.312}\times 1.671\left(-\frac{1.1056\times 10^{-52}-3\times\frac{1+1.5^2}{24^2}}{\pi}\right)^{0.312}\right)\right)$$

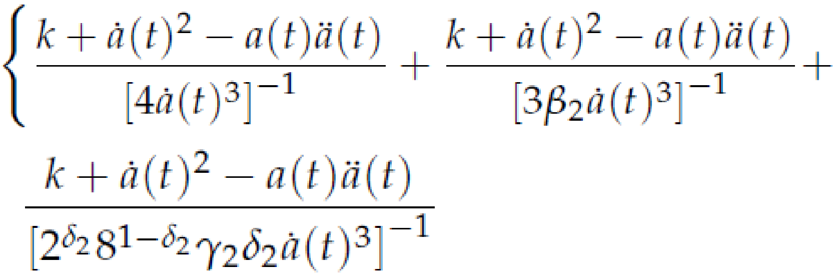
Result:



$1.09386\ldots \times 10^{-8}$

1.09386*10^-8

From:



$$\left\{\frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{[4\dot{a}(t)^3]^{-1}} + \frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{[3\beta_2\dot{a}(t)^3]^{-1}} + \right.$$

$$\frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{[2^{\delta_2}8^{1-\delta_2}\gamma_2\delta_2\dot{a}(t)^3]^{-1}}$$

(1/(4*1.5^3))^-1*(1+1.5^2-24*1.5)+(1/(3*0.3162*1.5^3)^-1)*(1+1.5^2-24*1.5)+1/(((2^(-0.576)*8^(1+0.576)*(-0.21)(-0.576)*1.5^3)))^-1

Input:

$$\frac{1+1.5^2-24\times 1.5}{\frac{1}{4\times 1.5^3}}+\frac{1}{\frac{1}{3\times 0.3162\times 1.5^3}}\left(1+1.5^2-24\times 1.5\right)+\frac{1}{\frac{\frac{1}{8^{1+0.576}\times(-0.21)\left(-0.576\times 1.5^3\right)}}{2^{0.576}}}$$

Result:

$-539.717\ldots$

-539.717

From:

$$\left[\frac{-\frac{\Lambda}{3}+\frac{k+\dot{a}(t)^2}{a(T)^2}}{\pi}\right]^{\delta_2-1}-\frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{\left[a(t)\dot{a}(t)\ddot{a}(t)\right]^{-1}}+$$

$$\left[3\dot{a}(t)^4+\dot{a}(t)^2[3k-5a(t)\ddot{a}(t)]+\frac{a(t)\ddot{a}(t)-k}{\left[a(t)\ddot{a}(t)\right]^{-1}}+a(t)^2\dot{a}(t)\dddot{a}(t)\right]\dot{a}(t)\Big\}$$

(((1/Pi)((-1/3*1.1056e-52+((1+1.5^2)/(24^2)))))^(-0.576-1) – ((((1/((24*1.5*1.5)^-1)))*(1+1.5^2-24*1.5))))+[(3*1.5^4+1.5^2(3-5*24*1.5)+(1/((24*1.5)^-1)(24*1.5-1)))+24^2*1.5*1.5]

Input interpretation:

$$\left(\left(\frac{1}{\pi}\left(-\frac{1}{3}\times 1.1056\times 10^{-52}+\frac{1+1.5^2}{24^2}\right)\right)^{-0.576-1}-\frac{1}{\frac{1}{24\times 1.5\times 1.5}}\left(1+1.5^2-24\times 1.5\right)\right)+$$

$$\left(\left(3\times 1.5^4+1.5^2\,(3-5\times 24\times 1.5)+\frac{1}{\frac{1}{24\times 1.5}}\,(24\times 1.5-1)\right)+24^2\times 1.5\times 1.5\right)$$

Result:

$25183.9\ldots$

25183.9

1.5

In conclusion, we obtain:

(13.4848+(-1.44594*10^-6)) (-2.35897435(0.106808+0.000238797))*1.5+1.09386*10^-8((-539.717*25183.9*1.5))

Input interpretation:

$$(13.4848 - 1.44594 \times 10^{-6})\,(-2.35897435\,(0.106808 + 0.000238797)) \times 1.5 + 1.09386 \times 10^{-8}\,(-539.717 \times 25\,183.9 \times 1.5)$$

Result:

−5.33080422416592196710061457 55

-5.33080422416592196710061457 55 final result

From which:

(-1/(ln(27)))[(13.4848+(-1.44594*10^-6)) (-2.35897435(0.106808+0.000238797))*1.5+1.09386*10^-8((-539.717*25183.9*1.5))]

Where

$\log(27) \approx 3.29583686$

Input interpretation:

$$-\frac{1}{\log(27)}\left((13.4848 - 1.44594 \times 10^{-6})\,(-2.35897435\,(0.106808 + 0.000238797)) \times 1.5 + 1.09386 \times 10^{-8}\,(-539.717 \times 25\,183.9 \times 1.5)\right)$$

log(x) is the natural logarithm

Result:

1.6174357047679555775513363569282115923190583144284984817885029111
…

1.617435704767…. result that is a very good approximation to the value of the golden ratio 1.618033988749...

From the algebraic sum of the two previous equations results, we obtain:

-(-5.3308042241659219671006145755-19.86912679)

Input interpretation:

$$-(-5.3308042241659219671006145755 - 19.86912679)$$

Result:

25.1999310141659219671006145755

25.199931014…. result very near to the value of S_{BH} entropy 25.1327

We obtain also:

-(19.86912679/(-5.3308042241659219671006145755))-((5 Γ(1/3)^(3/2))/(6 sqrt(π)))*((((√(10-2√5) -2))/((√5-1))))

Input interpretation:

$$-\left(-\frac{19.86912679}{5.3308042241659219671006145755}\right)-\frac{5\,\Gamma\left(\frac{1}{3}\right)^{3/2}}{6\sqrt{\pi}}\times\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}$$

$\Gamma(x)$ is the gamma function

Result:

3.141593600…

3.1415936…. ≈ π

Alternative representations:

$$\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}-1\right)\left(6\sqrt{\pi}\right)}=$$
$$\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{5\left(\left(-\frac{2}{3}\right)!\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{\left(-1+\sqrt{5}\right)\left(6\sqrt{\pi}\right)}$$

$$\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}-1\right)\left(6\sqrt{\pi}\right)}=$$
$$\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{5\left(\frac{G\left(\frac{4}{3}\right)}{G\left(\frac{1}{3}\right)}\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{\left(-1+\sqrt{5}\right)\left(6\sqrt{\pi}\right)}$$

$$\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}-1\right)\left(6\sqrt{\pi}\right)}=$$
$$\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{5\left(e^{-\log G(1/3)+\log G(4/3)}\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{\left(-1+\sqrt{5}\right)\left(6\sqrt{\pi}\right)}$$

Series representations:

$$\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}-1\right)\left(6\sqrt{\pi}\right)} = -\left(\left(2.5\left(1.49089\sqrt{-1+\pi}\sum_{k=0}^{\infty}(-1+\pi)^{-k}\binom{\frac{1}{2}}{k} - 3.4641\left(\sum_{k=0}^{\infty}\frac{3^{-k}\,\Gamma^{(k)}(1)}{k!}\right)^{3/2} + 1.73205\sqrt{9-2\sqrt{5}}\left(\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9-2\sqrt{5}\right)^{-k}\right)\left(\sum_{k=0}^{\infty}\frac{3^{-k}\,\Gamma^{(k)}(1)}{k!}\right)^{3/2} - 1.49089\sqrt{4}\,\sqrt{-1+\pi}\sum_{k_1=0}^{\infty}\sum_{k_2=0}^{\infty}4^{-k_1}\,(-1+\pi)^{-k_2}\binom{\frac{1}{2}}{k_1}\binom{\frac{1}{2}}{k_2}\right)\right)\Big/\left(\sqrt{-1+\pi}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)\sum_{k=0}^{\infty}(-1+\pi)^{-k}\binom{\frac{1}{2}}{k}\right)\right)$$

$$\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}-1\right)\left(6\sqrt{\pi}\right)} = \left(3.72723\left(-\sqrt{-1+\pi}\sum_{k=0}^{\infty}(-1+\pi)^{-k}\binom{\frac{1}{2}}{k} + 0.44716\left(\sum_{k=0}^{\infty}\frac{\left(\frac{1}{3}-z_0\right)^k\,\Gamma^{(k)}(z_0)}{k!}\right)^{3/2} - 0.22358\sqrt{9-2\sqrt{5}}\left(\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9-2\sqrt{5}\right)^{-k}\right)\left(\sum_{k=0}^{\infty}\frac{\left(\frac{1}{3}-z_0\right)^k\,\Gamma^{(k)}(z_0)}{k!}\right)^{3/2} + \sqrt{4}\,\sqrt{-1+\pi}\sum_{k_1=0}^{\infty}\sum_{k_2=0}^{\infty}4^{-k_1}\,(-1+\pi)^{-k_2}\binom{\frac{1}{2}}{k_1}\binom{\frac{1}{2}}{k_2}\right)\right)\Big/\left(\sqrt{-1+\pi}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)\sum_{k=0}^{\infty}(-1+\pi)^{-k}\binom{\frac{1}{2}}{k}\right)$$

for $(z_0 \notin \mathbb{Z}$ or $z_0 > 0)$

$$\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(\sqrt{10-2\sqrt{5}}\ -2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}\ -1\right)\left(6\sqrt{\pi}\,\right)} =$$

$$-\Bigg(\Bigg(2.5\Bigg(1.49089\sqrt{-1+\pi}\,\sum_{k=0}^{\infty}\frac{(-1)^k\,(-1+\pi)^{-k}\left(-\frac{1}{2}\right)_k}{k!} -$$

$$3.4641\left(\sum_{k=0}^{\infty}\frac{3^{-k}\,\Gamma^{(k)}(1)}{k!}\right)^{3/2} +$$

$$1.73205\sqrt{9-2\sqrt{5}}\,\left(\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(9-2\sqrt{5}\,\right)^{-k}}{k!}\right)$$

$$\left(\sum_{k=0}^{\infty}\frac{3^{-k}\,\Gamma^{(k)}(1)}{k!}\right)^{3/2} - 1.49089\sqrt{4}\,\sqrt{-1+\pi}$$

$$\sum_{k_1=0}^{\infty}\sum_{k_2=0}^{\infty}\frac{(-1)^{k_1+k_2}\,4^{-k_1}\,(-1+\pi)^{-k_2}\left(-\frac{1}{2}\right)_{k_1}\left(-\frac{1}{2}\right)_{k_2}}{k_1!\,k_2!}\Bigg)\Bigg)\Bigg/$$

$$\left(\sqrt{-1+\pi}\,\left(-1+\sqrt{4}\,\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)\sum_{k=0}^{\infty}\frac{(-1)^k\,(-1+\pi)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\Bigg)$$

Integral representations:

$$\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(\sqrt{10-2\sqrt{5}}\ -2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}\ -1\right)\left(6\sqrt{\pi}\,\right)} =$$

$$3.72723 - \frac{5\left(\int_0^{\infty}\frac{e^{-t}}{t^{2/3}}\,dt\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\,\right)}{6\left(-1+\sqrt{5}\,\right)\sqrt{\pi}}$$

$$\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(\sqrt{10-2\sqrt{5}}\ -2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}\ -1\right)\left(6\sqrt{\pi}\,\right)} =$$

$$3.72723 - \frac{5\left(\int_0^{1}\frac{1}{\log^{2/3}\left(\frac{1}{t}\right)}\,dt\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\,\right)}{6\left(-1+\sqrt{5}\,\right)\sqrt{\pi}}$$

$$\frac{-19.8691}{-5.3308042241659219671006145755 0000}-\frac{\left(\sqrt{10-2\sqrt{5}}-2\right)\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)}{\left(\sqrt{5}-1\right)\left(6\sqrt{\pi}\right)}=$$

$$3.72723-\frac{5\left(\csc\left(\frac{\pi}{6}\right)\int_0^\infty \frac{\sin(t)}{t^{2/3}}\,dt\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{6\left(-1+\sqrt{5}\right)\sqrt{\pi}}$$

1/6(-(19.86912679/(-5.3308042241659219671006145755))-((5 Γ(1/3)^(3/2))/(6 sqrt(π)))*((((√(10-2√5) -2))/((√5-1)))))^2

Where

$$\frac{5\,\Gamma\left(\frac{1}{3}\right)^{3/2}}{6\sqrt{\pi}}$$

= 2.06152184687887….

Input interpretation:

$$\frac{1}{6}\left(-\left(-\frac{19.86912679}{5.3308042241659219671006145755}\right)-\frac{5\,\Gamma\left(\frac{1}{3}\right)^{3/2}}{6\sqrt{\pi}}\times\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)^2$$

$\Gamma(x)$ is the gamma function

Result:

1.6449350574921181418636482898261287878941464441268546229560425805…

$1.644935057\ldots. \approx \zeta(2)=\frac{\pi^2}{6}=1.644934\ldots$

Alternative representations:

$$\frac{1}{6}\left(\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}-1\right)}\right)^2=$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{5\left(\left(-\frac{2}{3}\right)!\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{\left(-1+\sqrt{5}\right)\left(6\sqrt{\pi}\right)}\right)^2$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}-1\right)}\right)^2=$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.33080422416592196710061457550000}-\frac{5\left(\frac{G\left(\frac{4}{3}\right)}{G\left(\frac{1}{3}\right)}\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{\left(-1+\sqrt{5}\right)\left(6\sqrt{\pi}\right)}\right)^2$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.330804224165921967100614575500000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}-1\right)}\right)^2 =$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.330804224165921967100614575500000} - \frac{5\,\Gamma\left(\frac{1}{3},0\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{\left(-1+\sqrt{5}\right)\left(6\sqrt{\pi}\right)}\right)^2$$

Series representations:

$$\frac{1}{6}\left(\frac{-19.8691}{-5.330804224165921967100614575500000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}-1\right)}\right)^2 = \frac{1}{6}\left(3.72723 - \frac{5\sqrt{3}\left(-2+\sqrt{9-2\sqrt{5}}\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9-2\sqrt{5}\right)^{-k}\right)\left(\sum_{k=0}^{\infty}\frac{3^{-k}\,\Gamma^{(k)}(1)}{k!}\right)^{3/2}}{2\sqrt{-1+\pi}\left(-1+\sqrt{4}\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)\sum_{k=0}^{\infty}(-1+\pi)^{-k}\binom{\frac{1}{2}}{k}}\right)^2$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.3308042241659219671006145755000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}\;-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}\;-1\right)}\right)^2 = \frac{1}{6}\left(3.72723 - \frac{5\left(-2+\sqrt{9-2\sqrt{5}}\;\sum_{k=0}^{\infty}\binom{\frac{1}{2}}{k}\left(9-2\sqrt{5}\right)^{-k}\right)\left(\sum_{k=0}^{\infty}\frac{\left(\frac{1}{3}-z_0\right)^k\Gamma^{(k)}(z_0)}{k!}\right)^{3/2}}{6\sqrt{-1+\pi}\left(-1+\sqrt{4}\;\sum_{k=0}^{\infty}4^{-k}\binom{\frac{1}{2}}{k}\right)\sum_{k=0}^{\infty}(-1+\pi)^{-k}\binom{\frac{1}{2}}{k}}\right)^2 \quad \text{for } (z_0 \notin \mathbb{Z} \text{ or } z_0 > 0)$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.3308042241659219671006145755000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}\;-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}\;-1\right)}\right)^2 = \frac{1}{6}\left(3.72723 - \frac{5\sqrt{3}\left(-2+\sqrt{9-2\sqrt{5}}\;\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(9-2\sqrt{5}\right)^{-k}}{k!}\right)\left(\sum_{k=0}^{\infty}\frac{3^{-k}\,\Gamma^{(k)}(1)}{k!}\right)^{3/2}}{2\sqrt{-1+\pi}\left(-1+\sqrt{4}\;\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{4}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)\sum_{k=0}^{\infty}\frac{(-1)^k(-1+\pi)^{-k}\left(-\frac{1}{2}\right)_k}{k!}}\right)^2$$

$\binom{n}{m}$ is the binomial coefficient

$\mathbb{Z}$ is the set of integers

Integral representations:

$$\frac{1}{6}\left(\frac{-19.8691}{-5.3308042241659219671006145755000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}\;-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}\;-1\right)}\right)^2 = \frac{1}{6}\left(3.72723 - \frac{5\left(\int_0^1\frac{1}{\log^{2/3}\left(\frac{1}{t}\right)}\,dt\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{6\left(-1+\sqrt{5}\right)\sqrt{\pi}}\right)^2$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}\,-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}\,-1\right)}\right)^2 =$$

$$\frac{1}{6}\left(-3.72723 + \frac{5\left(\int_0^\infty \frac{e^{-t}}{t^{2/3}}\,dt\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{6\left(-1+\sqrt{5}\right)\sqrt{\pi}}\right)^2$$

$$\frac{1}{6}\left(\frac{-19.8691}{-5.33080422416592196710061457550000} - \frac{\left(5\,\Gamma\left(\frac{1}{3}\right)^{3/2}\right)\left(\sqrt{10-2\sqrt{5}}\,-2\right)}{\left(6\sqrt{\pi}\right)\left(\sqrt{5}\,-1\right)}\right)^2 =$$

$$\frac{1}{6}\left(-3.72723 + \frac{5\left(\csc\left(\frac{\pi}{6}\right)\int_0^\infty \frac{\sin(t)}{t^{2/3}}\,dt\right)^{3/2}\left(-2+\sqrt{10-2\sqrt{5}}\right)}{6\left(-1+\sqrt{5}\right)\sqrt{\pi}}\right)^2$$

Multiplying the two same results, after some calculations, we obtain:

16*(-(19.86912679*(-5.3308042241659219671006145755)))+34+((((√(10-2√5) -2))/((√5-1))))

Input interpretation:

$$16\,(-(19.86912679\times(-5.3308042241659219671006145755))) + 34 + \frac{\sqrt{10-2\sqrt{5}}\,-2}{\sqrt{5}\,-1}$$

Result:

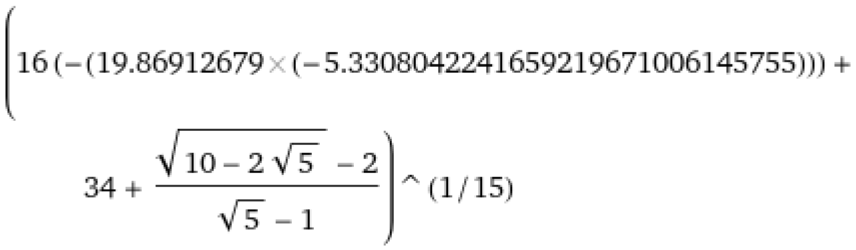
1728.978879…

1728.978879…. ≈ 1729

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. (1728 = $8^2 * 3^3$) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

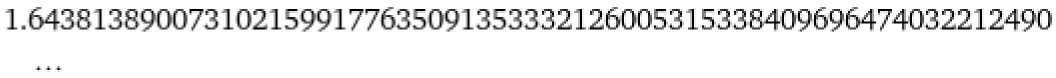
[16*(-(19.86912679*(-5.3308042241659219671006145755)))+34+((((√(10-2√5) -2))/((√5-1))))]^1/15

Input interpretation:



$$\left(16\left(-\left(19.86912679\times\left(-5.3308042241659219671006145755\right)\right)\right)+34+\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)\hat{}\,(1/15)$$

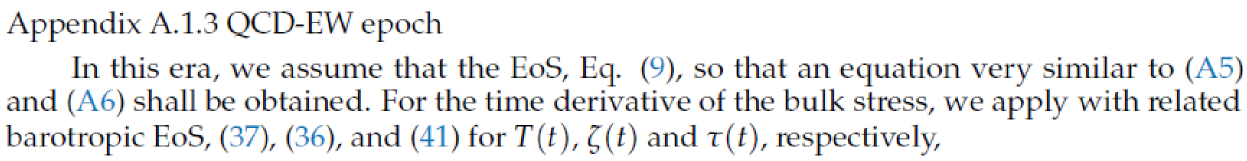
Result:



1.643813890073102159917763509135333212600531533840969647403 2212490 …

1.64381389….. ≈ ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ...

From:



Appendix A.1.3 QCD-EW epoch

In this era, we assume that the EoS, Eq. (9), so that an equation very similar to (A5) and (A6) shall be obtained. For the time derivative of the bulk stress, we apply with related barotropic EoS, (37), (36), and (41) for $T(t)$, $\zeta(t)$ and $\tau(t)$, respectively,

$$
\begin{aligned}
&-\alpha_2+\frac{\Lambda a(t)^2-3(k+\dot{a}(t)^2)}{8\pi a(t)^2}(1+\beta_2)-8^{\delta_2}\gamma_2\left[-\frac{1}{\pi}\left(\Lambda-\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\delta_2}+\frac{k+\dot{a}(t)^2-a(t)\ddot{a}(t)}{4\pi a(t)^2}+\\
&3\left[e_1+8^{-e_3}e_2\left(-\frac{1}{\pi}\left[\Lambda-\frac{3(k+\dot{a}(t)^2)}{a(t)}\right]\right)^{e_3}\right]\frac{\dot{a}(t)}{a(t)}+\epsilon\frac{3\times 2^{-4-3\delta_2}}{\pi a(t)^3}\left[h_1+\frac{h_2}{h_3+\log\left(\frac{h_4[-\Lambda a(t)^2+3(k+\dot{a}(t)^2]}{8\pi a(t)^2}\right)}\right]\\
&\left[-8^{\delta_2}\frac{k+\dot{a}(t)^2}{(1+3\beta_2)^{-1}}+a(t)^2\left[8^{\delta_2}(1+\beta_2)\Lambda-8\pi\left(8^{\delta_2}\alpha_2+\gamma_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2}\right)\right]-2^{1+3\delta_2}a(t)\ddot{a}(t)\right]\\
&\Bigg\{1-\frac{2h_2\left[k+\dot{a}(t)^2-a(t)\ddot{a}(t)\right]}{\left[h_3+\log\left(\frac{h_4[-\Lambda a(t)^2+3(k+\dot{a}(t)^2)]}{8\pi a(t)^2}\right)\right]\left[h_2+h_1h_3+h_1\log\left(\frac{h_4[-\Lambda a(t)^2+3(k+\dot{a}(t)^2)]}{8\pi a(t)^2}\right)\right][\Lambda a(t)^2-3[k+\dot{a}(t)^2]]}-\\
&\frac{2e_2e_3\left[k+\dot{a}(t)^2-a(t)\ddot{a}(t)\right]\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)}{a(t)^2}\right)\right]^{e_3}}{[\Lambda a(t)^2-3(k+\dot{a}(t)^2]\left(8^{e_3}e_1+e_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{e_3}\right)}-\\
&\frac{2\beta_4\gamma_4\left[k+\dot{a}(t)^2-a(t)\ddot{a}(t)\right]\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)}{a(t)^2}\right)\right]^{\gamma_4}}{[\Lambda a(t)^2-a(k+\dot{a}(t)^2]\left(8^{\gamma_4}\alpha_4+\beta_4\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\gamma_4}\right)}\Bigg\}\dot{a}(t)-\\
&\frac{\left[h_3+\log\left(\frac{h_4[-\Lambda a(t)^2+3(k+\dot{a}(t)^2]}{8\pi a(t)^2}\right)\right]^{-1}}{4\pi a(t)^3[\Lambda a(t)^2-3(k+\dot{a}(t)^2]}\Bigg\{\left[h_2+h_1h_3+h_1\log\left(\frac{h_4[-\Lambda a(t)^2+3(k+\dot{a}(t)^2]}{8\pi a(t)^2}\right)\right]\Bigg[\frac{3\dot{a}(t)^5}{(1+3\beta_2)^{-1}}+\\
&8^{\delta_2}\dot{a}(t)^3\left(\frac{3\times 2^{1+3\delta_2}}{(1+3\beta_2)^{-1}}-a(t)^2\left[\frac{8^{\delta_2}\Lambda}{(1+3\beta_2)^{-1}}-24\pi\gamma_2\delta_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\delta_2}\right]-3^2 8^{\delta_2}\beta_2 a(t)\ddot{a}(t)\right)+\\
&8^{-\delta_2}\dot{a}(t)\Bigg(\frac{3\times 8^{\delta_2}k^2}{(1+3\beta_2)^{-1}}-ka(t)^2\left[\frac{8^{\delta_1}\Lambda}{(1+3\beta_2)^{-1}}-24\pi\gamma_2\delta_1\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\delta_2}\right]-3^2 8^{\delta_2}k\beta_2 a(t)\ddot{a}(t)+\\
&3a(t)^3\left[8^{\delta_2}\beta_2\Lambda-8\pi\gamma_2\delta_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\delta_2}\right]\ddot{a}(t)\Bigg)+\frac{a(t)^2\dddot{a}(t)}{(-3k+\Lambda a(t)^2)^{-1}}-3a(t)^2\dot{a}(t)^2\dddot{a}(t)\Bigg]\Bigg\}=0. \qquad \text{(A8)}
\end{aligned}
$$

We have:

$\dot{a}(t) = 1.5\ ;\ \ a(t) = 24$

The various fit parameters are given as follows. For Hadron-QCD: $d_1 = -9.336 \pm 4.152$, $d_2 = 0.232 \pm 0.003$, $d_3 = 11.962 \pm 4.172$, and $d_4 = 0.087 \pm 0.029$. For QCD: $e_1 = 8.042 \pm 0.056$, $e_2 = 0.301 \pm 0.002$, and $e_3 = 0.945 \pm 0.0001$. For EW: $f_1 = 0.350 \pm 0.065$, $f_2 = 10.019 \pm 0.934$, and $f_3 = 0.929 \pm 8.898 \times 10^{-5}$.

where $\alpha_1 = 0.0034 \pm 0.0023$, $\beta_1 = 0.1991 \pm 0.0022$, $\alpha_2 = 0.0484 \pm 0.0164$, $\beta_2 = 0.3162 \pm 0.031$, $\gamma_2 = -0.21 \pm 0.014$, and $\delta_2 = -0.576 \pm 0.034$. At very large $\rho(t)$, the asymptotic behavior becomes very close to that of an ideal gas limit,

$$
\texttt{Asymp.}:\qquad p(t) \quad = \quad \gamma_3\rho(t), \qquad (10)
$$

where $\gamma_3 = 0.3304 \pm 0.0236$. It should be noticed that the EoS (8), in the hadronic phase, with

where $g_1 = 0.0002 \pm 1.945 \times 10^{-5}$, $g_2 = 0.008 \pm 0.001$, $g_3 = 1.671 \pm 0.097$, $g_4 = 0.312 \pm 0.0226$, $h_1 = -1.605 \times 10^{-7} \pm 2.556 \times 10^{-6}$, $h_2 = 0.0015 \pm 0.0013$, $h_3 = 0.935 \pm 1.084 \times 10^{5}$ $h_3 = 10.524 \pm 1.141 \times 10^{6}$, $k_1 = 9.582 \times 10^{-4} \pm 9.504 \times 10^{-5}$, $k_2 = 0.216 \pm 0.0035$, and $k_3 = 5.9 \times 10^{-7} \pm 9.165 \times 10^{-8}$.

where $\alpha_4 = 0.048 \pm 0.001$, $\beta_4 = 0.13 \pm 2 \times 10^{-4}$, and $\gamma_4 = 0.25 \pm 8 \times 10^{-5}$.

For $\dot{a}(t)$ = 1.5 ; $a(t)$ = 24 f_1 = 0.350 ; f_2 = 10.019 ; f_3 = 0.929 * 10^-5 ; ϵ = 1

k_1 = 9.582*10^-4 ; k_2 = 0.216 ; k_3 = 5.9*10^-7 ; γ_3 = 0.3304 ; Λ = 1.1056e-52

From:

$$-\alpha_2 + \frac{\Lambda a(t)^2 - 3(k + \dot{a}(t)^2)}{8\pi a(t)^2}(1+\beta_2) - 8^{\delta_2}\gamma_2\left[-\frac{1}{\pi}\left(\Lambda - \frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\delta_2} + \frac{k + \dot{a}(t)^2 - a(t)\ddot{a}(t)}{4\pi a(t)^2} +$$

-0.0484+(1/(8Pi*24^2))((1.1056e-52*24^2-3(1+1.5^2))(1+0.3162))-(1/8^(0.576))*(-0.21)* ((1/((((-(1/Pi)*(1.1056e-52-3((1+1.5^2)/(24^2)))))^(0.576)))))+(1/(4Pi*24^2))*(1+1.5^2-24*1.5)

Input interpretation:

$$-0.0484 + \frac{1}{8\pi \times 24^2}\left(\left(1.1056 \times 10^{-52} \times 24^2 - 3\left(1 + 1.5^2\right)\right)(1 + 0.3162)\right) - \frac{1}{8^{0.576}} \times (-0.21) \times \frac{1}{\left(-\frac{1}{\pi}\left(1.1056 \times 10^{-52} - 3 \times \frac{1+1.5^2}{24^2}\right)\right)^{0.576}} + \frac{1}{4\pi \times 24^2}\left(1 + 1.5^2 - 24 \times 1.5\right)$$

Result:

1.23069…

1.23069

From:

$$3\left[e_1 + 8^{-e_3}e_2\left(-\frac{1}{\pi}\left[\Lambda - \frac{3(k+\dot{a}(t)^2)}{a(t)}\right]\right)^{e_3}\right]\frac{\dot{a}(t)}{a(t)} + \epsilon\frac{3 \times 2^{-4-3\delta_2}}{\pi a(t)^3}\left[h_1 + \frac{h_2}{h_3 + \log\left(\frac{h_4\left[-\Lambda a(t)^2 + 3(k+\dot{a}(t)^2]\right]}{8\pi a(t)^2}\right)}\right]$$

3[8.042+(8^(-0.945))*0.301((((-(1/Pi)*(1.1056e-52-3((1+1.5^2)/(24^2)))))^0.945]*1.5/24+(1/(Pi*24^3))*(3*2^(-4-3*(-0.576)))

Input interpretation:

$$3\left(8.042+\frac{0.301\left(-\frac{1}{\pi}\left(1.1056\times 10^{-52}-3\times\frac{1+1.5^2}{24^2}\right)\right)^{0.945}}{8^{0.945}}\right)\times\frac{1.5}{24}+\frac{1}{\pi\times 24^3}\left(3\times 2^{-4-3\times(-0.576)}\right)$$

Result:

1.50795…

1.50795[-1.605e-7+(0.0015)/(0.935e+5+ln((((1/(8Pi*24^2))*10.524e+6(-1.1056e-52*24^2+3(1+1.5^2))))]

Input interpretation:

$$1.50795\left(-1.605\times 10^{-7}+0.0015\middle/\left(0.935\times 10^{5}+\log\left(\frac{1}{8\,\pi\times 24^2}\times 10.524\times 10^{6}\left(-1.1056\times 10^{-52}\times 24^2+3\left(1+1.5^2\right)\right)\right)\right)\right)$$

log(x) is the natural logarithm

Result:

$-2.17837\ldots\times 10^{-7}$

-2.17837*10^-7

From:

$$\left[-8^{\delta_2}\frac{k+\dot{a}(t)^2}{(1+3\beta_2)^{-1}}+a(t)^2\left[8^{\delta_2}(1+\beta_2)\Lambda-8\pi\left(8^{\delta_2}\alpha_2+\gamma_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2}\right)\right]-2^{1+3\delta_2}a(t)\ddot{a}(t)\right]$$

[(1/(1+3*(0.3162))^-1)(-8^(-0.576)*(1+1.5^2))+24^2(8^(-0.576)(1+0.3162)*1.1056e-52-8Pi(8^(-0.576)*0.0484-0.21(((((1/Pi)*(-1.1056e-52+3((1+1.5^2)/(24^2)))))^(-0.576)))))-2^(1+3*(-0.576))*24*1.5]

Input interpretation:

$$\frac{\frac{1}{\frac{1}{1+3\times 0.3162}}\left(-\left(1+1.5^2\right)\right)}{8^{0.576}}+24^2\left(\frac{(1+0.3162)\times 1.1056\times 10^{-52}}{8^{0.576}}-8\,\pi\left(\frac{0.0484}{8^{0.576}}-\frac{0.21}{\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{1+1.5^2}{24^2}\right)\right)^{0.576}}\right)\right)-2^{1+3\times(-0.576)}\times 24\times 1.5$$

Result:

61364.3…

61364.3

From:

$$\left\{1-\frac{2h_2\left[k+\dot{a}(t)^2-a(t)\ddot{a}(t)\right]}{\left[h_3+\log\left(\frac{h_4\left[-\Lambda a(t)^2+3(k+\dot{a}(t)^2)\right]}{8\pi a(t)^2}\right)\right]\left[h_2+h_1h_3+h_1\log\left(\frac{h_4\left[-\Lambda a(t)^2+3(k+\dot{a}(t)^2)\right]}{8\pi a(t)^2}\right)\right]\left[\Lambda a(t)^2-3[k+\dot{a}(t)^2]\right]}-\right.$$

1-1/(0.935e-5+ln(((1/(8Pi*576))10.524e+6(-1.1056e-52*576+3(3.25))))0.0015-1.605e-7*0.935e+5-1.605e-7 ln(((1/(8Pi*576))10.524e+6(-1.1056e-52*576+3(3.25))))((1.1056e-52*276-3(3.25))))(2*0.0015(3.25-36))

Input interpretation:

$$1-1\Big/\left(0.935\times 10^{-5}+\log\left(\frac{1}{8\,\pi\times 576}\times 10.524\times 10^{6}\left(-1.1056\times 10^{-52}\times 576+3\times 3.25\right)\right)\times 0.0015-1.605\times 10^{-7}\times 0.935\times 10^{5}-1.605\times 10^{-7}\left(\log\left(\frac{1}{8\,\pi\times 576}\times 10.524\times 10^{6}\left(-1.1056\times 10^{-52}\times 576+3\times 3.25\right)\right)\left(1.1056\times 10^{-52}\times 276-3\times 3.25\right)\right)\right)(2\times 0.0015\,(3.25-36))$$

$\log(x)$ is the natural logarithm

Result:

$-57.3332\ldots$

From:

$$\frac{2e_2e_3\left[k+\dot{a}(t)^2-a(t)\ddot{a}(t)\right]\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t))}{a(t)^2}\right)\right]^{e_3}}{\left[\Lambda a(t)^2-3(k+\dot{a}(t)^2\right]\left(8^{e_3}e_1+e_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{e_3}\right)}-$$

-57.3332-1/[((((1.1056e-52*576-3(1+2.25)((8^0.945)*8.042+0.301(((1/Pi)*(-1.1056e-52+3((1+2.25)/(576)))))^(0.945))))))]*2*0.301*0.945(1+2.25-36)*(((1/Pi)*(-1.1056e-52+3((1+2.25)/(576)))))^(0.945)

Input interpretation:

$$-57.3332-1\Big/\left(1.1056\times10^{-52}\times576-3\,(1+2.25)\left(8^{0.945}\times8.042+0.301\left(\frac{1}{\pi}\left(-1.1056\times10^{-52}+3\times\frac{1+2.25}{576}\right)\right)^{0.945}\right)\right)\times2\times0.301\times0.945\left((1+2.25-36)\left(\frac{1}{\pi}\left(-1.1056\times10^{-52}+3\times\frac{1+2.25}{576}\right)\right)^{0.945}\right)$$

Result:

$-57.3334\ldots$

From:

$$\left.\frac{2\beta_4\gamma_4\left[k+\dot{a}(t)^2-a(t)\ddot{a}(t)\right]\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)}{a(t)^2}\right)\right]^{\gamma_4}}{\left[\Lambda a(t)^2-a(k+\dot{a}(t)^2\right]\left(8^{\gamma_4}\alpha_4+\beta_4\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2}{a(t)^2}\right)\right]^{\gamma_4}\right)}\right\}\dot{a}(t)-$$

-114.6666-1/[(((1.1056e-52*576-3(3.25)((8^(0.25e-5))*0.048+0.13e-4 (((1/Pi)(-1.1056e-52+3((2.5)/(576)))))^(0.25e-5)))))][(2*0.13e-4*0.25e-5(3.25-36)(((1/Pi)(-1.1056e-52+3((2.5)/(576)))))^(0.25e-5)))

Input interpretation:

$$-114.6666 - 1 \Big/ \left(1.1056 \times 10^{-52} \times 576 - 3 \times 3.25 \left(8^{0.25 \times 10^{-5}} \times 0.048 + 0.13 \times 10^{-4} \left(\frac{1}{\pi} \left(-1.1056 \times 10^{-52} + 3 \times \frac{2.5}{576}\right)\right)^{0.25 \times 10^{-5}}\right)\right) \left(2 \times 0.13 \times 10^{-4} \times 0.25 \times 10^{-5} \, (3.25 - 36) \left(\frac{1}{\pi} \left(-1.1056 \times 10^{-52} + 3 \times \frac{2.5}{576}\right)\right)^{0.25 \times 10^{-5}}\right)$$

Result:

−114.6666…

(-114.6666-1/[(1.1056e-52*576-3(3.25)((8^(0.25e-5))*0.048+0.13e-4 (((1/Pi)(-1.1056e-52+3((2.5)/(576)))))^(0.25e-5)))][(2*0.13e-4*0.25e-5(3.25-36)(((1/Pi)(-1.1056e-52+3((2.5)/(576)))^(0.25e-5)))))1.5

Input interpretation:

$$\left(-114.6666 - 1 \Big/ \left(1.1056 \times 10^{-52} \times 576 - 3 \times 3.25 \left(8^{0.25 \times 10^{-5}} \times 0.048 + 0.13 \times 10^{-4} \left(\frac{1}{\pi} \left(-1.1056 \times 10^{-52} + 3 \times \frac{2.5}{576}\right)\right)^{0.25 \times 10^{-5}}\right)\right) \left(2 \times 0.13 \times 10^{-4} \times 0.25 \times 10^{-5} \, (3.25 - 36) \left(\frac{1}{\pi} \left(-1.1056 \times 10^{-52} + 3 \times \frac{2.5}{576}\right)^{0.25 \times 10^{-5}}\right)\right)\right) \times 1.5$$

Result:

−172.000…

-172

From:

$$\frac{\left[h_3 + \log\left(\frac{h_4\left[-\Lambda a(t)^2+3(k+\dot{a}(t)^2\right]}{8\pi a(t)^2}\right)\right]^{-1}}{4\pi a(t)^3\left[\Lambda a(t)^2 - 3(k + \dot{a}(t)^2\right]}$$

1/(4Pi*24^3(1.1056e-52*576-3(3.25))*1/(((0.935*10^5+ln(((1/(8Pi*576))10.524e+6(-1.1056e-52*576+3(3.25)))))))

Input interpretation:

$$1\Big/\left(4\,\pi\times 24^3\left(\left(1.1056\times 10^{-52}\times 576-3\times 3.25\right)\times 1\Big/\left(0.935\times 10^5+\log\left(\frac{1}{8\,\pi\times 576}\times 10.524\times 10^6\left(-1.1056\times 10^{-52}\times 576+3\times 3.25\right)\right)\right)\right)\right)$$

$\log(x)$ is the natural logarithm

Result:

−0.0552083…

-0.0552083

From:

$$\left\{\left[h_2 + h_1 h_3 + h_1\log\left(\frac{h_4\left[-\Lambda a(t)^2+3(k+\dot{a}(t)^2\right]}{8\pi a(t)^2}\right)\right]\right.$$

(((0.0015-1.605e-7*0.935e+5-1.605e-7*ln(((1/(8Pi*576))10.524e+6(-1.1056e-52*576+3(3.25))

Input interpretation:

$$0.0015-1.605\times 10^{-7}\times 0.935\times 10^5-1.605\times 10^{-7}\log\left(\frac{1}{8\,\pi\times 576}\times 10.524\times 10^6\left(-1.1056\times 10^{-52}\times 576+3\times 3.25\right)\right)$$

$\log(x)$ is the natural logarithm

Result:

$-0.0135082\ldots$

-0.0135082

From:

$$\left[\frac{3\dot{a}(t)^5}{(1+3\beta_2)^{-1}}+\right.$$

$$8^{\delta_2}\dot{a}(t)^3\left(\frac{3\times 2^{1+3\delta_2}}{(1+3\beta_2)^{-1}}-a(t)^2\left[\frac{8^{\delta_2}\Lambda}{(1+3\beta_2)^{-1}}-24\pi\gamma_2\delta_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2}\right]-3^2 8^{\delta_2}\beta_2 a(t)\ddot{a}(t)\right)$$

$+$

-0.0135082*(((1/(1+3*0.3162)^-1)*3(1.5)^5+(1/(8^(-0.576)))*1.5^3((1/(1+3*0.3162)^-1)*3*2^(1+3*(-0.576))-576

Input interpretation:

$$-0.0135082\times\frac{1}{\frac{1}{1+3\times 0.3162}}\times 3\times 1.5^5+$$

$$\frac{1}{\frac{1}{8^{0.576}}}\times 1.5^3\left(\frac{1}{\frac{1}{1+3\times 0.3162}}\times 3\times 2^{1+3\times(-0.576)}\right)-576$$

Result:

-537.14049985128375

From:

$$\left[\frac{8^{\delta_2}\Lambda}{(1+3\beta_2)^{-1}}-24\pi\gamma_2\delta_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2}\right]-3^2 8^{\delta_2}\beta_2 a(t)\ddot{a}(t)\Bigg)$$

-537.14049985128375* ((((1/(1+3*0.3162)^-1)*(8^((-0.576)(1.1056e-52))-24Pi*(-0.576)*(-0.21)* (((1/Pi)(-1.1056e-52+3((3.25)/(576)))))^(-0.576))-9*8^(-0.576)*0.3162*36)))

Input interpretation:

$$-537.14049985128375\left(\frac{1}{\frac{1}{1+3\times 0.3162}}\left(8^{-0.576\times 1.1056\times 10^{-52}}-\frac{24\,\pi\times(-0.576)\times(-0.21)}{\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{3.25}{576}\right)\right)^{0.576}}\right)-\frac{9\times 0.3162\times 36}{8^{0.576}}\right)$$

Result:

$2.08988\ldots\times 10^{5}$

2.08988 × 10^5 ((8^(-0.576)))*1.5^3

Input interpretation:

$$\frac{2.08988\times 10^{5}\times 1.5^{3}}{8^{0.576}}$$

Result:

$2.12919\ldots\times 10^{5}$

2.12919*10^5

From:

$$8^{-\delta_2}\dot{a}(t)\left(\frac{3\times 8^{\delta_2}k^2}{(1+3\beta_2)^{-1}}-ka(t)^2\left[\frac{8^{\delta_1}\Lambda}{(1+3\beta_2)^{-1}}-24\pi\gamma_2\delta_1\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2}\right]-3^2 8^{\delta_2}k\beta_2 a(t)\ddot{a}(t)+\right.$$

((8^(-0.576)))*1.5*((((((1/(1+3*0.3162)^-1)) (3*8^(-0.576))-576*((1.9486*8^((-0.576))*(1.1056e-52))-24Pi*(-0.576)*(-0.21)*(((1/Pi)(-1.1056e-52+3((3.25)/(576)))))^(-0.576)))-9*8^(-0.576)*0.3162*36)))

Input interpretation:

$$\frac{1}{8^{0.576}}\,1.5\left(\left(\frac{1}{\frac{1}{1+3\times 0.3162}}\times\frac{3}{8^{0.576}}-576\left(\frac{1.9486\times 1.1056\times 10^{-52}}{8^{0.576}}-\frac{24\,\pi\times(-0.576)\times(-0.21)}{\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{3.25}{576}\right)\right)^{0.576}}\right)\right)-\frac{9\times 0.3162\times 36}{8^{0.576}}\right)$$

Result:

48185.1…

48185.1

From:

$$3a(t)^3\left[8^{\delta_2}\beta_2\Lambda-8\pi\gamma_2\delta_2\left[\frac{1}{\pi}\left(-\Lambda+\frac{3(k+\dot{a}(t)^2)}{a(t)^2}\right)\right]^{\delta_2}\right]\ddot{a}(t)\Big)+\frac{a(t)^2\dddot{a}(t)}{(-3k+\Lambda a(t)^2)^{-1}}-3a(t)^2\dot{a}(t)^2\dddot{a}(t)\Big]\Big\}$$

3*1.5^3[(8^(-0.576))*0.3162*1.1056e-52-8Pi*(-0.576)*(-0.21) (((1/Pi)(-1.1056e-52+3((3.25)/(576)))))^(-0.576)*1.5+1/(((-3*1.1056e-52*576)^-1))*576*1.5-3*576*1.5^3]

Input interpretation:

$$3\times 1.5^3\left(\frac{0.3162\times 1.1056\times 10^{-52}}{8^{0.576}}-(8\,\pi\times(-0.576)\times(-0.21))\times\frac{1.5}{\left(\frac{1}{\pi}\left(-1.1056\times 10^{-52}+3\times\frac{3.25}{576}\right)\right)^{0.576}}+\frac{1}{-\frac{1}{3\times 1.1056\times 10^{-52}\times 576}}\times 576\times 1.5-3\times 576\times 1.5^3\right)$$

Result:

$-59984.5\ldots$

-59984.5

In conclusion, we obtain:

1.23069 -2.17837*10^-7*61364.3*(-172)+0.0552083*(-0.0135082*2.12919*10^5+48185.1-59984.5)

Input interpretation:

$$1.23069 + 2.17837 \times 10^{-7} \times (-172) \times (-61\,364.3) + 0.0552083\,(-0.0135082 \times 2.12919 \times 10^{5} + 48\,185.1 - 59\,984.5)$$

Result:

-806.68241615809194

-806.68241615809194 final result

Or, changing the sign:

-(1.23069 -2.17837*10^-7*61364.3*(-172)+0.0552083*(-0.0135082*2.12919*10^5+48185.1-59984.5))

Input interpretation:

$$-\left(1.23069 + 2.17837 \times 10^{-7} \times (-172) \times (-61\,364.3) + 0.0552083\,(-0.0135082 \times 2.12919 \times 10^{5} + 48\,185.1 - 59\,984.5)\right)$$

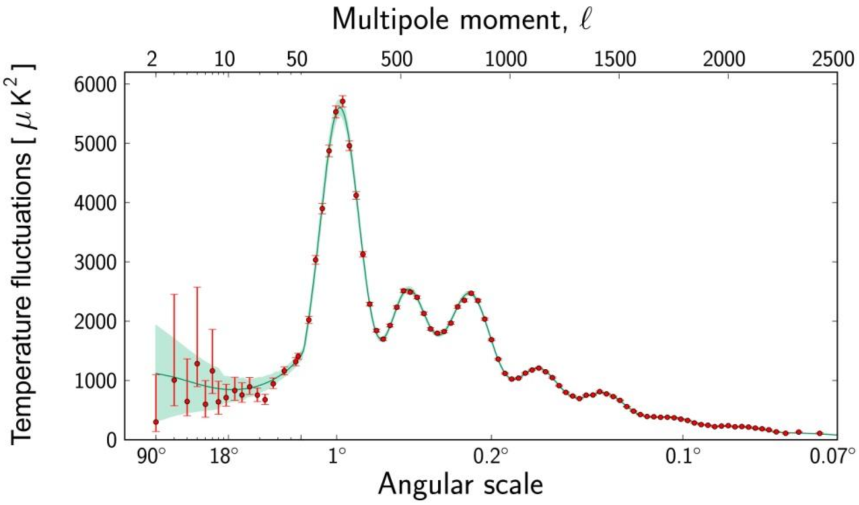
Result:

806.68241615809194

806.68241615809194

From:

The Sound of the Big Bang (washington.edu)



We note that

(see “PlanckData.txt (Input file containing the Planck multipole spectrum, size 1.56 kb”):

…………

1225	907.4000244140625
1256	793.9600219726562
1287	732.75
1318	689.4500122070312
1349	746.75
1380	749.6199951171875
1411	**806.22998046875**
1442	768.3400268554688
1473	722.6799926757812
1504	658.8300170898438
1535	554.47998046875
1566	477.6600036621094
1597	420.0199890136719
1628	387.2099914550781
1659	382.8500061035156
1690	373.95001220703125
1721	374.45001220703125
1752	365.19000244140625

………….

the result of the above expression 806.68241615809194 is almost equal to the value of Planck multipole spectrum data 806.22998046875

From the three obtained results, after some calculations, we obtain:

-806.68241615809194 *Pi/ (19.86912679 * (-5.3308042241659219671006145755))

Input interpretation:

$$-806.68241615809194\times\frac{\pi}{19.86912679\times(-5.3308042241659219671006145755)}$$

Result:

23.92659777…

23.92659777…. result almost equal to the value of BH entropy ln(24157197490) = 23.9078

Alternative representations:

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)}=\frac{-145\,202.834908456549200\,{}^{\circ}}{-105.918}$$

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)}=-\frac{806.682416158091940000\,i\log(-1)}{105.918}$$

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = \frac{-806.682416158091940000\cos^{-1}(-1)}{-105.918}$$

Series representations:

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = 30.4643\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2k}$$

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = -15.2321 + 15.2321\sum_{k=1}^{\infty}\frac{2^k}{\binom{2k}{k}}$$

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = 7.61607\sum_{k=0}^{\infty}\frac{2^{-k}(-6+50k)}{\binom{3k}{k}}$$

Integral representations:

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = 15.2321\int_0^{\infty}\frac{1}{1+t^2}\,dt$$

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = 30.4643\int_0^{1}\sqrt{1-t^2}\,dt$$

$$\frac{\pi(-1)\,806.682416158091940000}{19.8691\,(-5.33080422416592196710061457550000)} = 15.2321\int_0^{\infty}\frac{\sin(t)}{t}\,dt$$

And:

72((-806.68241615809194 *Pi/ (19.86912679 * (-5.3308042241659219671006145755))))+2Pi

Input interpretation:

$$72\left(-806.68241615809194\times\frac{\pi}{19.86912679\times(-5.3308042241659219671006145755)}\right)+2\pi$$

Result:

1728.998225…

1728.998225…. ≈ 1729

This result is very near to the mass of candidate glueball **f_0(1710) scalar meson.** Furthermore, 1728 occurs in the algebraic formula for the j-invariant of an elliptic curve. (1728 = 8^2 * 3^3) The number 1728 is one less than the Hardy–Ramanujan number 1729 (taxicab number)

Alternative representations:

$$\frac{72\,(-806.68241615809194000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=360\,°-\,-\frac{1.0454604113408871542\times10^{7}\,°}{105.918}$$

$$\frac{72\,(-806.68241615809194000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=-2\,i\log(-1)+-\frac{58\,081.1339633826196800\,i\log(-1)}{105.918}$$

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=$$
$$2\cos^{-1}(-1)--\frac{58\,081.1339633826196800\cos^{-1}(-1)}{105.918}$$

Series representations:

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=2201.43\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2\,k}$$

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=$$
$$-1100.71+1100.71\sum_{k=1}^{\infty}\frac{2^k}{\binom{2\,k}{k}}$$

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=$$
$$550.357\sum_{k=0}^{\infty}\frac{2^{-k}\,(-6+50\,k)}{\binom{3\,k}{k}}$$

Integral representations:

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=1100.71\int_0^{\infty}\frac{1}{1+t^2}\,dt$$

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.3308042241659219671006145755000)}+2\,\pi=$$
$$2201.43\int_0^1\sqrt{1-t^2}\,dt$$

$$\frac{72\,(-806.682416158091940000)\,\pi}{19.8691\,(-5.33080422416592196710061457550000)} + 2\,\pi = 1100.71 \int_0^{\infty} \frac{\sin(t)}{t}\,dt$$

((72((-806.68241615809194 *Pi/ (19.86912679 * (-5.33080422416592196710061457 55))))+2Pi))^1/15

Input interpretation:

$$\left(72\left(-806.68241615809194 \times \frac{\pi}{19.86912679 \times (-5.33080422416592196710061457 55)}\right) + 2\,\pi\right)\text{^}(1/15)$$

Result:

1.643815116248097627100985958188569618083528716630689189412173151 0
…

1.643815116248….. ≈ $\zeta(2) = \frac{\pi^2}{6} = 1.644934$ ...

(1/27((72((-806.68241615809194 *Pi/ (19.86912679 * (-5.33080422416592196710061457 55))))+2Pi)))^2-2-e

Input interpretation:

$$\left(\frac{1}{27}\left(72\left(-806.68241615809194 \times \frac{\pi}{19.86912679 \times (-5.33080422416592196710061457 55)}\right) + 2\,\pi\right)\right)^2 - 2 - e$$

Result:

4096.015411…

4096.015411…. ≈ 4096 = 64^2

Alternative representations:

$$\left(\frac{1}{27}\left(\frac{72(-806.682416158091940000\,\pi)}{19.8691(-5.33080422416592196710061457550000)}+2\pi\right)\right)^2-2-e = -2-e+\left(\frac{1}{27}\left(360\,°--\frac{1.04546041134088715424\times10^7\,°}{105.918}\right)\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72(-806.682416158091940000\,\pi)}{19.8691(-5.33080422416592196710061457550000)}+2\pi\right)\right)^2-2-e = -2-e+\left(\frac{1}{27}\left(-2\,i\log(-1)+-\frac{58\,081.1339633826196800\,i\log(-1)}{105.918}\right)\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72(-806.682416158091940000\,\pi)}{19.8691(-5.33080422416592196710061457550000)}+2\pi\right)\right)^2-2-e = \left(\frac{1}{27}\left(\frac{72(-806.682416158091940000\,\pi)}{19.8691(-5.33080422416592196710061457550000)}+2\pi\right)\right)^2-2-\exp(z)\quad \text{for } z=1$$

Series representations:

$$\left(\frac{1}{27}\left(\frac{72(-806.682416158091940000\,\pi)}{19.8691(-5.33080422416592196710061457550000)}+2\pi\right)\right)^2-2-e = 6647.86\left(-0.000300849+\left(\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2k}\right)^2-0.000150424\sum_{k=0}^{\infty}\frac{1}{k!}\right)$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e=$$
$$6647.86\left(-0.000300849+\left(\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2\,k}\right)^2-0.000150424\sum_{k=0}^{\infty}\frac{(-1+k)^2}{k!}\right)$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e=$$
$$-\left(2+\sum_{k=0}^{\infty}\frac{1}{k!}-415.491\left(\sum_{k=1}^{\infty}4^{-k}\left(-1+3^k\right)\zeta(1+k)\right)^2\right)$$

Integral representations:

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e=$$
$$-2-e+1661.96\left(\int_0^{\infty}\frac{1}{1+t^2}\,dt\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e=$$
$$-2-e+6647.86\left(\int_0^{1}\sqrt{1-t^2}\,dt\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e=$$
$$-2-e+1661.96\left(\int_0^{\infty}\frac{\sin(t)}{t}\,dt\right)^2$$

(1/27((72((-806.68241615809194 *Pi/ (19.86912679 * (-5.330804224165921967100614575 5))))+2Pi)))^2-2-e+276

Input interpretation:

$$\left(\frac{1}{27}\left(72\left(-806.68241615809194\times\frac{\pi}{19.86912679\times(-5.3308042241659219671006145755)}\right)+2\pi\right)\right)^2-2-e+276$$

Result:

4372.015411…

4372.015411…. ≈ 4372

Where 4372 is a value indicated in the fundamental Ramanujan paper “**Modular equations and Approximations to *π***”

Hence

$$\begin{aligned}64g_{22}^{24} &= e^{\pi\sqrt{22}}-24+276e^{-\pi\sqrt{22}}-\cdots,\\ 64g_{22}^{-24} &= 4096e^{-\pi\sqrt{22}}+\cdots,\end{aligned}$$

so that

$$64(g_{22}^{24}+g_{22}^{-24})=e^{\pi\sqrt{22}}-24+4372e^{-\pi\sqrt{22}}+\cdots=64\{(1+\sqrt{2})^{12}+(1-\sqrt{2})^{12}\}.$$

Hence

$$e^{\pi\sqrt{22}}=2508951.9982\ldots.$$

Alternative representations:

$$\left(\frac{1}{27}\left(\frac{72\,(-806.68241615809194000\,\pi)}{19.8691\,(-5.3308042241659219671006145755 0000)}+2\,\pi\right)\right)^2-2-e+276=$$

$$274-e+\left(\frac{1}{27}\left(360\,^{\circ}--\frac{1.04546041134088715424\times10^{7}\,^{\circ}}{105.918}\right)\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$274-e+\left(\frac{1}{27}\left(-2\,i\log(-1)+-\frac{58\,081.1339633826196800\,i\log(-1)}{105.918}\right)\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-$$
$$2-\exp(z)+276\quad\text{for } z=1$$

Series representations:

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$6647.86\left(0.0412163+\left(\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2\,k}\right)^2-0.000150424\sum_{k=0}^{\infty}\frac{1}{k!}\right)$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$6647.86\left(0.0412163+\left(\sum_{k=0}^{\infty}\frac{(-1)^k}{1+2\,k}\right)^2-0.000150424\sum_{k=0}^{\infty}\frac{(-1+k)^2}{k!}\right)$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.330804224165921967100614575500000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$-\left(-274+\sum_{k=0}^{\infty}\frac{1}{k!}-415.491\left(\sum_{k=1}^{\infty}4^{-k}\left(-1+3^k\right)\zeta(1+k)\right)^2\right)$$

Integral representations:

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.33080422416592196710061457550000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$274-e+1661.96\left(\int_0^\infty \frac{1}{1+t^2}\,dt\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.33080422416592196710061457550000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$274-e+6647.86\left(\int_0^1 \sqrt{1-t^2}\,dt\right)^2$$

$$\left(\frac{1}{27}\left(\frac{72\,(-806.682416158091940000\,\pi)}{19.8691\,(-5.33080422416592196710061457550000)}+2\,\pi\right)\right)^2-2-e+276=$$
$$274-e+1661.96\left(\int_0^\infty \frac{\sin(t)}{t}\,dt\right)^2$$

We note that, from the principal expression, after some calculations highlighted in red, we obtain also:

1/4(1/Pi[-(1.23069 -2.17837*10^-7*61364.3*(-172)+0.0552083*(-0.0135082*2.12919*10^5+48185.1-59984.5))]-1/sqrt2)

Input interpretation:

$$\frac{1}{4}\left(\frac{1}{\pi}\left(-\left(1.23069+2.17837\times10^{-7}\times(-172)\times(-61\,364.3)+0.0552083\left(-0.0135082\times2.12919\times10^{5}+48\,185.1-59\,984.5\right)\right)\right)-\frac{1}{\sqrt{2}}\right)$$

Result:

64.0170…

64.0170…. ≈ 64 = 8^2

We have also:

1/2[-(1.23069 -2.17837*10^-7*61364.3*(-172)+0.0552083*(-0.0135082*2.12919*10^5+48185.1-59984.5))]+8^2+3^3+2^1/3

Input interpretation:

$$\frac{1}{2}\left(-\left(1.23069+2.17837\times10^{-7}\times(-172)\times(-61\,364.3)+0.0552083\left(-0.0135082\times2.12919\times10^{5}+48\,185.1-59\,984.5\right)\right)\right)+8^{2}+3^{3}+\sqrt[3]{2}$$

Result:

495.601…

495.601…. result very near to the value of the Phi frequencies Table 495.672

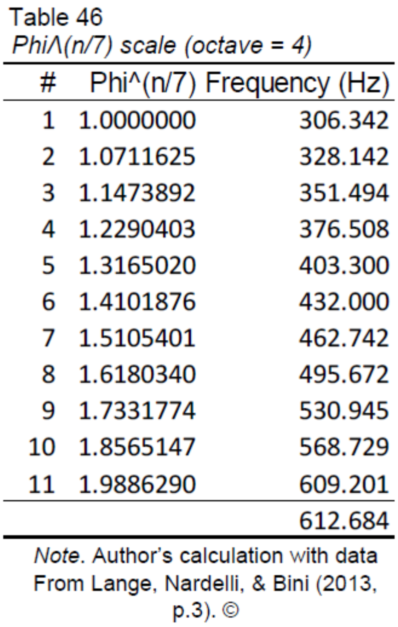


Table 46

Phi^(n/7) scale (octave = 4)

#	Phi^(n/7)	Frequency (Hz)
1	1.0000000	306.342
2	1.0711625	328.142
3	1.1473892	351.494
4	1.2290403	376.508
5	1.3165020	403.300
6	1.4101876	432.000
7	1.5105401	462.742
8	1.6180340	495.672
9	1.7331774	530.945
10	1.8565147	568.729
11	1.9886290	609.201
		612.684

Note. Author's calculation with data From Lange, Nardelli, & Bini (2013, p.3). ©

Table of Frequency System based on Phi

1/306.342(1/2[-(1.23069 -2.17837*10^-7*61364.3*(-172)+0.0552083*(-0.0135082*2.12919*10^5+48185.1-59984.5))]+8^2+3^3+2^1/3)

Where 306.342 is a value of the Phi frequencies Table

Input interpretation:

$$\frac{1}{306.342}\left(\frac{1}{2}\left(-\left(1.23069+2.17837\times 10^{-7}\times(-172)\times(-61\,364.3)+0.0552083\left(-0.0135082\times 2.12919\times 10^{5}+48\,185.1-59\,984.5\right)\right)\right)+8^{2}+3^{3}+\sqrt[3]{2}\right)$$

Result:

1.6178033998894726911907841908953986993313690302495299631786760389 …

1.61780339988…. result that is a very good approximation to the value of the golden ratio 1.618033988749...

In conclusion, we note that:

1/2((-(1.23069 -2.17837*10^-7*61364.3*(-172)+0.0552083*(-0.0135082*2.12919*10^5+48185.1-59984.5))))

Input interpretation:

$$\frac{1}{2}\left(-\left(1.23069+2.17837\times 10^{-7}\times(-172)\times(-61\,364.3)+0.0552083\left(-0.0135082\times 2.12919\times 10^{5}+48\,185.1-59\,984.5\right)\right)\right)$$

Result:

403.34120807904597

403.34120807904597 result very near to the value of the Phi frequencies Table 403.3

From these two CMB frequencies (see reference regarding the CMB data):

387,21

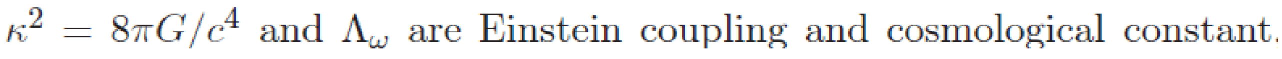
420,02

We have the following mean: (387.21 + 420.02)/2 = 403.615 result very near to the above value 403.3412….and also to the Phi frequencies Table 403.30

From:

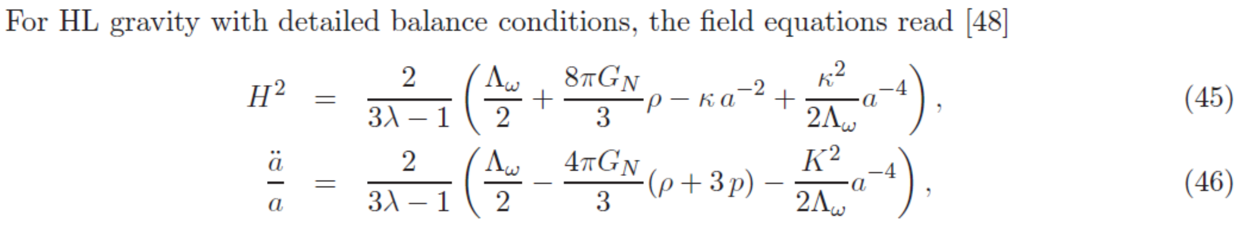
FLRW Cosmology with Horava-Lifshitz Gravity: Impacts of Equations of State
A. Tawfik and E. Abou El Dahab - ECTP-2014-09 - WLCAPP-2014-09

We have that:



$\kappa^2 = 8\pi G/c^4$ and Λ_ω are Einstein coupling and cosmological constant.

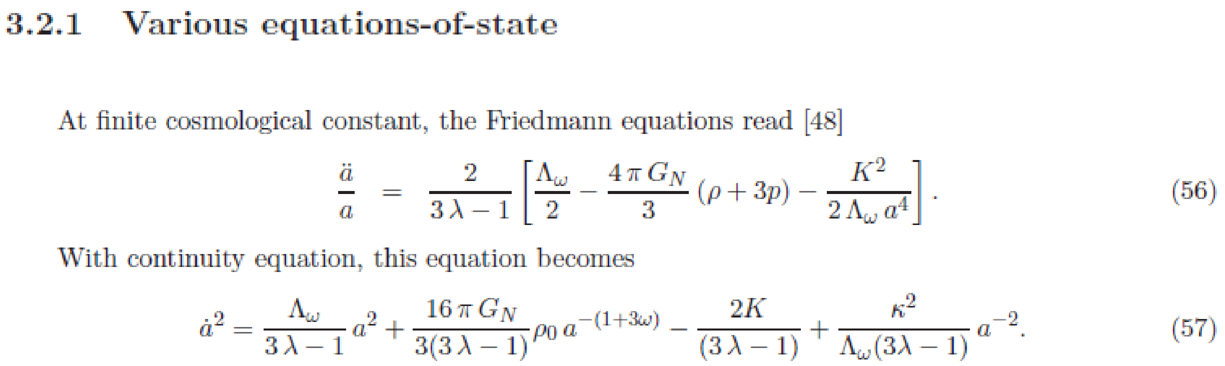
$\rho_0 = 1$ and $\mu = 0.5$, $\lambda = 0.9$



For HL gravity with detailed balance conditions, the field equations read [48]

$$H^2 = \frac{2}{3\lambda - 1}\left(\frac{\Lambda_\omega}{2} + \frac{8\pi G_N}{3}\rho - \kappa\, a^{-2} + \frac{\kappa^2}{2\Lambda_\omega} a^{-4}\right), \tag{45}$$

$$\frac{\ddot{a}}{a} = \frac{2}{3\lambda - 1}\left(\frac{\Lambda_\omega}{2} - \frac{4\pi G_N}{3}(\rho + 3\,p) - \frac{K^2}{2\Lambda_\omega} a^{-4}\right), \tag{46}$$



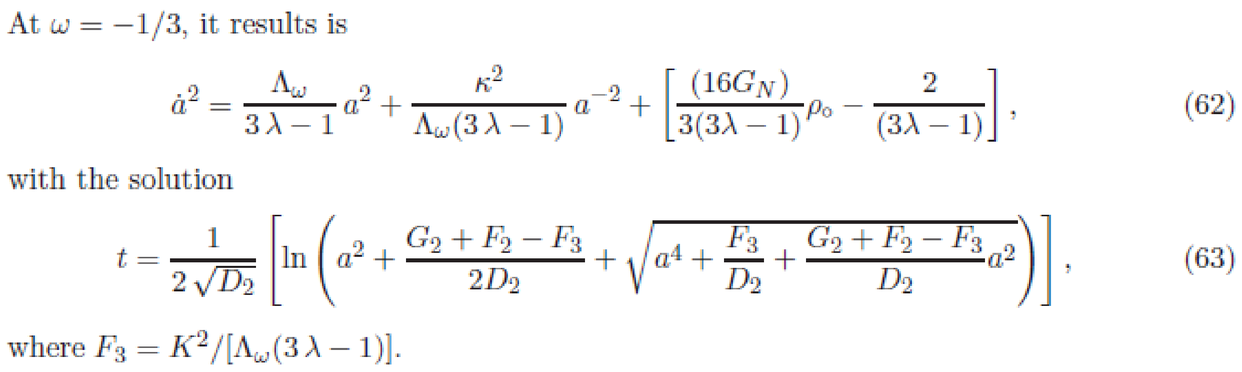
3.2.1 Various equations-of-state

At finite cosmological constant, the Friedmann equations read [48]

$$\frac{\ddot{a}}{a} = \frac{2}{3\,\lambda - 1}\left[\frac{\Lambda_\omega}{2} - \frac{4\,\pi\, G_N}{3}\,(\rho + 3p) - \frac{K^2}{2\,\Lambda_\omega\, a^4}\right]. \tag{56}$$

With continuity equation, this equation becomes

$$\dot{a}^2 = \frac{\Lambda_\omega}{3\,\lambda - 1} a^2 + \frac{16\,\pi\, G_N}{3(3\,\lambda - 1)} \rho_0\, a^{-(1+3\omega)} - \frac{2K}{(3\,\lambda - 1)} + \frac{\kappa^2}{\Lambda_\omega (3\lambda - 1)}\, a^{-2}. \tag{57}$$



At $\omega = -1/3$, it results is

$$\dot{a}^2 = \frac{\Lambda_\omega}{3\,\lambda - 1}a^2 + \frac{\kappa^2}{\Lambda_\omega(3\,\lambda - 1)}\,a^{-2} + \left[\frac{(16 G_N)}{3(3\lambda - 1)}\rho_o - \frac{2}{(3\lambda - 1)}\right], \qquad (62)$$

with the solution

$$t = \frac{1}{2\sqrt{D_2}}\left[\ln\left(a^2 + \frac{G_2 + F_2 - F_3}{2D_2} + \sqrt{a^4 + \frac{F_3}{D_2} + \frac{G_2 + F_2 - F_3}{D_2}a^2}\right)\right], \qquad (63)$$

where $F_3 = K^2/[\Lambda_\omega(3\,\lambda - 1)]$.

For:

$$D_2 = \Lambda_\omega/(3\,\lambda{-}1)$$

$$F_2 = 16\,\pi\,G_N\,\rho_0/[3(3\,\lambda{-}1)]{+}K^2/[\Lambda_\omega(3\,\lambda{-}1)]$$

$$F_3 = K^2/[\Lambda_\omega(3\,\lambda - 1)].$$

$$G_2 = -\tfrac{2K}{3\lambda-1}.$$

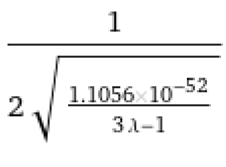
From:

$$\frac{1}{2\sqrt{D_2}}\left[\ln\left(a^2 + \frac{G_2 + F_2 - F_3}{2D_2} + \sqrt{a^4 + \frac{F_3}{D_2} + \frac{G_2 + F_2 - F_3}{D_2}a^2}\right)\right]$$

we obtain:

1/(2sqrt((1.1056e-52)/(3λ-1)))

Input interpretation:



$$\frac{1}{2\sqrt{\frac{1.1056\times10^{-52}}{3\,\lambda-1}}}$$

Result:

$$\frac{4.75522\times 10^{25}}{\sqrt{\frac{1}{3\lambda-1}}}$$

(a^2+1/(2*((1.1056e-52)/(3λ-1))))*((-2κ)/(3λ-1))+(16Pi*6.67408e-11)/(3(3λ-1))+κ^2/((1.1056e-52(3λ-1)))-(κ^2/(1.1056e-52(3λ-1)))

Input interpretation:

$$\left(a^2+\frac{1}{2\times\frac{1.1056\times 10^{-52}}{3\lambda-1}}\right)\times\frac{-2\kappa}{3\lambda-1}+\frac{16\pi\times 6.67408\times 10^{-11}}{3(3\lambda-1)}+\frac{\kappa^2}{1.1056\times 10^{-52}(3\lambda-1)}-\frac{\kappa^2}{1.1056\times 10^{-52}(3\lambda-1)}$$

Result:

$$-\frac{2\kappa\left(a^2+4.52243\times 10^{51}(3\lambda-1)\right)}{3\lambda-1}+\frac{1.11825\times 10^{-9}}{3\lambda-1}+0$$

Alternate form assuming a, κ, and λ are real:

$$-\frac{0.666667\kappa\left(a^2+1.35673\times 10^{52}\lambda-4.52243\times 10^{51}\right)}{\lambda-0.333333}-\frac{1.11825\times 10^{-9}}{1-3\lambda}+0$$

Expanded form:

$$-\frac{2a^2\kappa}{3\lambda-1}+\frac{9044862518089726230993936993213082285197812048068608\kappa}{3\lambda-1}-\frac{27134587554269177363753815194723373951786375863861248\kappa\lambda}{3\lambda-1}+\frac{1.11825\times 10^{-9}}{3\lambda-1}$$

Root:

$$\kappa \neq 0\,, \quad \lambda \approx \frac{1.87239\times 10^{-65}\left(-3.9365\times 10^{12}\,\kappa\, a^2 + 1.78025\times 10^{64}\,\kappa + 2201\right)}{\kappa}\,,$$

$$1.18095\times 10^{13}\, a^2\, \kappa - 1.30813\times 10^{49}\, \kappa - 6603 \neq 0$$

Root for the variable λ:

$$\lambda \approx \frac{1}{\kappa} 1.87239\times 10^{-65}\left(-3\,936\,497\,948\,915\, a^2\, \kappa + 17\,802\,541\,375\,339\,186\,144\,618\,382\,436\,317\,937\,707\,717\,989\,268\,684\,367\ddots 617\,186\,594\,816\,\kappa + 2201\right)$$

Derivative:

$$\frac{\partial}{\partial a}\left(-\frac{1}{3\lambda - 1} 2\,\kappa\left(a^2 + 4\,522\,431\,259\,044\,863\,115\,496\,968\,496\,606\,541\,142\,598\,906\,024\,034\ddots 304\,(3\lambda - 1)\right) + \frac{1.11825\times 10^{-9}}{3\lambda - 1} + 0\right) = \frac{4\, a\, \kappa}{1 - 3\lambda}$$

Indefinite integral:

$$\int\left(\frac{\left(a^2 + \frac{1}{\frac{2\,1.1056\times 10^{-52}}{3\lambda - 1}}\right)(-2\,\kappa)}{3\lambda - 1} + \frac{16\,\pi\, 6.67408\times 10^{-11}}{3\,(3\lambda - 1)} + \frac{\kappa^2}{1.1056\times 10^{-52}\,(3\lambda - 1)} - \frac{\kappa^2}{1.1056\times 10^{-52}\,(3\lambda - 1)}\right) da = -\frac{0.222222\, a^3\, \kappa}{\lambda - 0.333333} - \frac{0.666667\, a\, \kappa\left(1.35673\times 10^{52}\,\lambda - 4.52243\times 10^{51}\right)}{\lambda - 0.333333} - \frac{1.11825\times 10^{-9}\, a}{1 - 3\lambda} + \text{constant}$$

Limit:

$$\lim_{\lambda\to\pm\infty}\left(0+\frac{1.11825\times10^{-9}}{-1+3\lambda}-\frac{2\kappa\left(a^2+4.52243\times10^{51}\,(-1+3\lambda)\right)}{-1+3\lambda}\right)=$$
$$-9.04486\times10^{51}\,\kappa$$

sqrt[(a^4+1/((1.1056e-52))/(3λ-1))(κ^2)/(1.1056e-52(3λ-1))+1/((1.1056e-52)/(3λ-1))((-2κ)/(3λ-1))+(16Pi*6.67408e-11)/(3(3λ-1))+(((κ^2)/((1.1056e-52(3λ-1))))-(κ^2)/((1.1056e-52(3λ-1))))a^2]

Input interpretation:

$$\sqrt{\left(\left(a^4+\frac{\frac{1}{1.1056\times10^{-52}}}{3\lambda-1}\right)\times\frac{\kappa^2}{1.1056\times10^{-52}\,(3\lambda-1)}+\frac{1}{\frac{1.1056\times10^{-52}}{3\lambda-1}}\times\frac{-2\kappa}{3\lambda-1}+\frac{16\pi\times6.67408\times10^{-11}}{3\,(3\lambda-1)}+\left(\frac{\kappa^2}{1.1056\times10^{-52}\,(3\lambda-1)}-\frac{\kappa^2}{1.1056\times10^{-52}\,(3\lambda-1)}\right)a^2\right)}$$

Result:

$$\sqrt{\frac{9.04486\times10^{51}\,\kappa^2\left(a^4+\frac{9.04486\times10^{51}}{3\lambda-1}\right)}{3\lambda-1}-1.80897\times10^{52}\,\kappa+\frac{1.11825\times10^{-9}}{3\lambda-1}+0}$$

Alternate forms:

$$\sqrt{\left(\frac{3.01495\times10^{51}\,\kappa^2\left(a^4\,(\lambda-0.333333)+3.01495\times10^{51}\right)}{(0.333333-\lambda)^2}-1.80897\times10^{52}\,\kappa-\frac{1.11825\times10^{-9}}{1-3\lambda}\right)}$$

$$\sqrt{\left(\frac{1}{(3\,\lambda-1)^2}\left(\kappa^2\left(9.04486\times 10^{51}\,a^4\,(3\,\lambda-1)+8.18095\times 10^{103}\right)-1.80897\times 10^{52}\,\kappa\,(3\,\lambda-1)^2+1.11825\times 10^{-9}\,(3\,\lambda-1)\right)\right)}$$

Expanded form:

$$\sqrt{\left(\frac{9\,044\,862\,518\,089\,726\,230\,993\,936\,993\,213\,082\,285\,197\,812\,048\,068\,608\,a^4\,\kappa^2}{3\,\lambda-1}+\frac{1}{9\,\lambda^2-6\,\lambda+1}\,81\,809\,537\,971\,144\,425\,210\,998\,401\,194\,372\,594\,093\,852\,399\,169\,983\,402\,616\,926\,120\,895\,216\,779\,621\,174\,490\,892\,798\,165\,277\,082\,078\,150\,656\,\kappa^2-18\,089\,725\,036\,179\,452\,461\,987\,873\,986\,426\,164\,570\,395\,624\,096\,137\,216\,\kappa+\frac{1.11825\times 10^{-9}}{3\,\lambda-1}\right)}$$

Derivative:

$$\frac{\partial}{\partial a}\left(\sqrt{\left(\frac{1}{3\,\lambda-1}\,9\,044\,862\,518\,089\,726\,230\,993\,936\,993\,213\,082\,285\,197\,812\,048\,068\,608\,\kappa^2\left(a^4+9\,044\,862\,518\,089\,726\,230\,993\,936\,993\,213\,082\,285\,197\,812\,048\,068\,608/(3\,\lambda-1)\right)-18\,089\,725\,036\,179\,452\,461\,987\,873\,986\,426\,164\,570\,395\,624\,096\,137\,216\,\kappa+\frac{1.11825\times 10^{-9}}{3\,\lambda-1}+0\right)}\right)=$$

$$\left(6\,029\,908\,345\,393\,150\,820\,662\,624\,662\,142\,054\,856\,798\,541\,365\,379\,072\,a^3\,\kappa^2\right)\Big/\left((\lambda-0.333333)\,\sqrt{\left(\frac{1}{(0.333333-\lambda)^2}\,3\,014\,954\,172\,696\,575\,410\,331\,312\,331\,071\,027\,428\,399\,270\,682\,689\,536\,\kappa^2\left(a^4\,(\lambda-0.333333)+3\,014\,954\,172\,696\,575\,410\,331\,312\,331\,071\,027\,428\,399\,270\,682\,689\,536\right)-18\,089\,725\,036\,179\,452\,461\,987\,873\,986\,426\,164\,570\,395\,624\,096\,137\,216\,\kappa-\frac{1.11825\times 10^{-9}}{1-3\,\lambda}\right)}\right)$$

From:

$$\frac{4.75522\times 10^{25}}{\sqrt{\frac{1}{3\lambda-1}}}$$

$$-\frac{2\kappa\left(a^2+4.52243\times 10^{51}\,(3\lambda-1)\right)}{3\lambda-1}+\frac{1.11825\times 10^{-9}}{3\lambda-1}+0$$

$$\sqrt{\frac{9.04486\times 10^{51}\,\kappa^2\left(a^4+\frac{9.04486\times 10^{51}}{3\lambda-1}\right)}{3\lambda-1}-1.80897\times 10^{52}\,\kappa+\frac{1.11825\times 10^{-9}}{3\lambda-1}+0}$$

we obtain:

(4.75522e+25)/sqrt(1/(3λ-1))ln(((1.11825e-9)/(3λ-1)-(2κ(a^2+4.52243e+51 (3λ-1)))/(3 λ-1)))+sqrt((9.04486e+51 κ^2 (a^4 +(9.04486e+51)/(3λ-1)))/(3λ-1)-1.80897e+52 κ +(1.11825e-9)/(3λ-1))

Input interpretation:

$$\frac{4.75522\times 10^{25}}{\sqrt{\frac{1}{3\lambda-1}}}\log\left(\frac{1.11825\times 10^{-9}}{3\lambda-1}-\frac{2\kappa\left(a^2+4.52243\times 10^{51}\,(3\lambda-1)\right)}{3\lambda-1}\right)+\sqrt{\frac{9.04486\times 10^{51}\,\kappa^2\left(a^4+\frac{9.04486\times 10^{51}}{3\lambda-1}\right)}{3\lambda-1}-1.80897\times 10^{52}\,\kappa+\frac{1.11825\times 10^{-9}}{3\lambda-1}}$$

$\log(x)$ is the natural logarithm

Result:

$$\sqrt{\frac{9.04486\times 10^{51}\,\kappa^2\left(a^4+\frac{9.04486\times 10^{51}}{3\,\lambda-1}\right)}{3\,\lambda-1}-1.80897\times 10^{52}\,\kappa+\frac{1.11825\times 10^{-9}}{3\,\lambda-1}}+\frac{4.75522\times 10^{25}\log\left(\frac{1.11825\times 10^{-9}}{3\,\lambda-1}-\frac{2\,\kappa\left(a^2+4.52243\times 10^{51}\,(3\,\lambda-1)\right)}{3\,\lambda-1}\right)}{\sqrt{\frac{1}{3\,\lambda-1}}}$$

Alternate forms:

$$\sqrt{\left(\frac{3.01495\times 10^{51}\,\kappa^2\left(a^4\,(\lambda-0.333333)+3.01495\times 10^{51}\right)}{(0.333333-\lambda)^2}-1.80897\times 10^{52}\,\kappa-\frac{1.11825\times 10^{-9}}{1-3\,\lambda}\right)+\frac{4.75522\times 10^{25}\log\left(\frac{3.7275\times 10^{-10}-0.666667\,a^2\,\kappa}{\lambda-0.333333}-9.04486\times 10^{51}\,\kappa\right)}{\sqrt{\frac{1}{3\,\lambda-1}}}}$$

$$\sqrt{\left(\frac{1}{(3\,\lambda-1)^2}\left(\kappa^2\left(9.04486\times 10^{51}\,a^4\,(3\,\lambda-1)+8.18095\times 10^{103}\right)-1.80897\times 10^{52}\,\kappa\,(3\,\lambda-1)^2+1.11825\times 10^{-9}\,(3\,\lambda-1)\right)\right)+\frac{1}{\sqrt{\frac{1}{3\,\lambda-1}}}\left(4.75522\times 10^{25}\log\left(\frac{\kappa\left(-2\,a^2-2.71346\times 10^{52}\,\lambda+9.04486\times 10^{51}\right)+1.11825\times 10^{-9}}{\lambda-0.333333}\right)-5.22414\times 10^{25}\right)}$$

$$\frac{1}{\sqrt{\frac{1}{3\lambda-1}}}\left(\sqrt{\frac{1}{3\lambda-1}}\;\sqrt{\left(\frac{1}{(3\lambda-1)^2}\left(9.04486\times10^{51}\,a^4\,\kappa^2\,(3\lambda-1)+8.18095\times10^{103}\,\kappa^2-1.80897\times10^{52}\,\kappa\,(3\lambda-1)^2+1.11825\times10^{-9}\,(3\lambda-1)\right)\right)}+4.75522\times10^{25}\log\left(\frac{-2\,a^2\,\kappa-2.71346\times10^{52}\,\kappa\,\lambda+9.04486\times10^{51}\,\kappa+1.11825\times10^{-9}}{\lambda-0.333333}\right)-5.22414\times10^{25}\right)$$

Expanded form:

$$\sqrt{\left(\frac{9\,044\,859\,999\,999\,999\,668\,797\,977\,562\,617\,195\,584\,790\,462\,698\,881\,024\,a^4\,\kappa^2}{3\lambda-1}+\frac{1}{9\lambda^2-6\lambda+1}81\,809\,492\,419\,600\,001\,939\,746\,691\,451\,152\,868\,616\,100\,660\,505\,947\,303\,388\,788\,355\,887\,821\,749\,380\,909\,748\,955\,533\,625\,499\,451\,031\,289\,856\,\kappa^2-18\,089\,700\,000\,000\,000\,035\,812\,972\,332\,161\,513\,655\,933\,168\,787\,652\,608\,\kappa+\frac{1.11825\times10^{-9}}{3\lambda-1}\right)}+\frac{1}{\sqrt{\frac{1}{3\lambda-1}}}47\,552\,199\,999\,999\,994\,125\,877\,248\log\left(-\frac{2\,a^2\,\kappa}{3\lambda-1}+\frac{9\,044\,859\,999\,999\,999\,668\,797\,977\,562\,617\,195\,584\,790\,462\,698\,881\,024\,\kappa}{3\lambda-1}-\frac{27\,134\,579\,999\,999\,999\,006\,393\,932\,687\,851\,586\,754\,371\,388\,096\,643\,072\,\kappa\,\lambda}{3\lambda-1}+\frac{1.11825\times10^{-9}}{3\lambda-1}\right)$$

Alternate forms assuming a, κ, and λ are positive:

$$\sqrt{\left(\frac{3.01495\times 10^{51}\,\kappa^{2}\left(a^{4}\,(\lambda-0.333333)+3.01495\times 10^{51}\right)}{(0.333333-\lambda)^{2}}-1.80897\times 10^{52}\,\kappa-\frac{1.11825\times 10^{-9}}{1-3\,\lambda}\right)+4.75522\times 10^{25}\,\sqrt{3\,\lambda-1}\,\log\left(\frac{\kappa\left(-0.666667\,a^{2}-9.04486\times 10^{51}\,\lambda+3.01495\times 10^{51}\right)+3.7275\times 10^{-10}}{\lambda-0.333333}\right)(-1)^{\lfloor(\arg(3\,\lambda-1)+\pi)/(2\,\pi)\rfloor}}$$

$$\sqrt{\frac{9.04486\times 10^{51}\,\kappa^{2}\left(a^{4}+\frac{9.04486\times 10^{51}}{3\,\lambda-1}\right)}{3\,\lambda-1}-1.80897\times 10^{52}\,\kappa+\frac{1.11825\times 10^{-9}}{3\,\lambda-1}}+4.75522\times 10^{25}\,\sqrt{3\,\lambda-1}\,e^{i\,\pi\,\lfloor\arg(3\,\lambda-1)/(2\,\pi)+1/2\rfloor}\log\left(\frac{1.11825\times 10^{-9}}{3\,\lambda-1}-\frac{2\,\kappa\left(a^{2}+4.52243\times 10^{51}\,(3\,\lambda-1)\right)}{3\,\lambda-1}\right)$$

Derivative:

$$\frac{\partial}{\partial a}\left(\sqrt{\left(\frac{1}{3\lambda-1} 9044859999999999668797977562617195584790462698881024\,\kappa^2\left(a^4+9044859999999999668797977562617195584790462698881024/(3\lambda-1)\right)-18089700000000000035812972332161513655933168787652608\,\kappa+\frac{1.11825\times10^{-9}}{3\lambda-1}\right)}+\frac{1}{\sqrt{\frac{1}{3\lambda-1}}}47552199999999994125877248\log\left(\frac{1.11825\times10^{-9}}{3\lambda-1}-\frac{1}{3\lambda-1}2\kappa\left(a^2+4522429999999999834398988781308597792395231349440512\,(3\lambda-1)\right)\right)\right)=$$

$$a\,\kappa\left(\left(6029906666666665559713321185134215120655601612357632\,a^2\,\kappa\right)\Big/\left((\lambda-0.333333)\sqrt{\left(\left(3014953333333332779856660592567107560327800806178816\,\kappa^2\left(a^4(\lambda-0.333333)+3014953333333333444470658485025044012231330946351104\right)\right)\Big/(0.333333-\lambda)^2-18089700000000000035812972332161513655933168787652608\,\kappa-\frac{1.11825\times10^{-9}}{1-3\lambda}\right)}\right)-\left(570626399999999963870265344\,(\lambda-0.333333)\sqrt{\frac{1}{3\lambda-1}}\right)\Big/\left(\kappa\left(-2a^2-27134579999999999006393932687851586754371388096643072\,\lambda+9044859999999999668797977562617195584790462698881024\right)+1.11825\times10^{-9}\right)\right)$$

For λ = 0.9 :

(4.75522e+25)/sqrt(1/(2.7-1))ln(((1.11825e-9)/(2.7-1)-(2κ(a^2+4.52243e+51 (2.7-1)))/(2.7-1)))+sqrt((9.04486e+51 κ^2 (a^4 +(9.04486e+51)/(2.7-1)))/(2.7-1)-1.80897e+52 κ +(1.11825e-9)/(2.7-1))

Input interpretation:

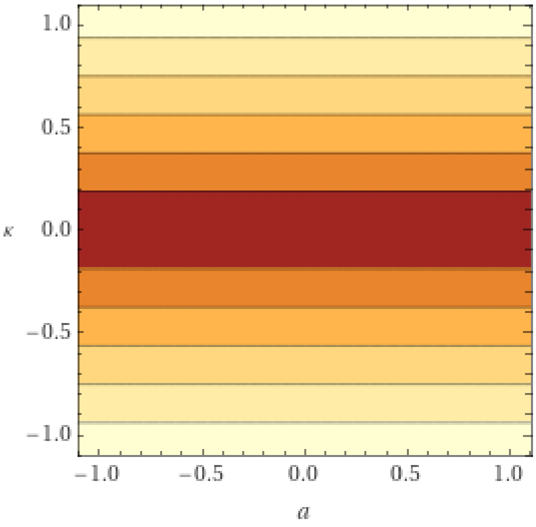
$$\frac{4.75522\times 10^{25}}{\sqrt{\frac{1}{2.7-1}}}\log\left(\frac{1.11825\times 10^{-9}}{2.7-1}-\frac{2\,\kappa\left(a^2+4.52243\times 10^{51}\,(2.7-1)\right)}{2.7-1}\right)+\sqrt{\frac{9.04486\times 10^{51}\,\kappa^2\left(a^4+\frac{9.04486\times 10^{51}}{2.7-1}\right)}{2.7-1}-1.80897\times 10^{52}\,\kappa+\frac{1.11825\times 10^{-9}}{2.7-1}}$$

$\log(x)$ is the natural logarithm

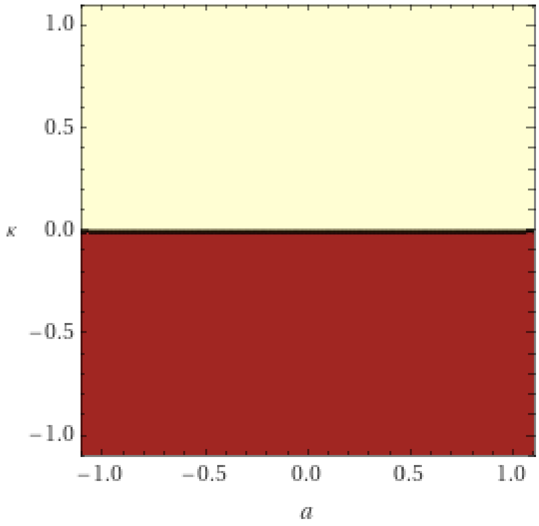
Result:

$$\sqrt{5.32051\times 10^{51}\left(a^4+5.32051\times 10^{51}\right)\kappa^2-1.80897\times 10^{52}\,\kappa+6.57794\times 10^{-10}}+6.20005\times 10^{25}\log\left(6.57794\times 10^{-10}-1.17647\left(a^2+7.68813\times 10^{51}\right)\kappa\right)$$

Contour plots:
Real part



Imaginary part



Alternate forms:

$$\sqrt{\kappa\left(\left(5.32051\times10^{51}\,a^4+2.83078\times10^{103}\right)\kappa-1.80897\times10^{52}\right)+6.57794\times10^{-10}}+6.20005\times10^{25}\log\left(6.57794\times10^{-10}-1.17647\left(a^2+7.68813\times10^{51}\right)\kappa\right)$$

$$\sqrt{5.32051\times10^{51}\,a^4\,\kappa^2+2.83078\times10^{103}\,\kappa^2-1.80897\times10^{52}\,\kappa+6.57794\times10^{-10}}+6.20005\times10^{25}\log\left(a^2\,(-\kappa)-7.68813\times10^{51}\,\kappa+5.59125\times10^{-10}\right)+1.00763\times10^{25}$$

$$\sqrt{\left(5.32051\times10^{51}\,a^4+2.83078\times10^{103}\right)\kappa^2-1.80897\times10^{52}\,\kappa+6.57794\times10^{-10}}+6.20005\times10^{25}\log\left(\left(-a^2-7.68813\times10^{51}\right)\kappa+5.59125\times10^{-10}\right)+1.00763\times10^{25}$$

Alternate forms assuming a and κ are positive:

$$\sqrt{5.32051\times10^{51}\left(a^4+5.32051\times10^{51}\right)\kappa^2-1.80897\times10^{52}\,\kappa+6.57794\times10^{-10}}+6.20005\times10^{25}\log\left(1.17647\left(a^2+7.68813\times10^{51}\right)\kappa-6.57794\times10^{-10}\right)+1.9478\times10^{26}\,i$$

$$\sqrt{5.32051\times 10^{51}\left(a^4+5.32051\times 10^{51}\right)\kappa^2-1.80897\times 10^{52}\,\kappa+6.57794\times 10^{-10}}+6.20005\times 10^{25}\left(\log\left(1.17647\left(a^2+7.68813\times 10^{51}\right)\kappa-6.57794\times 10^{-10}\right)+i\,\pi\right)$$

Series expansion at a=0:

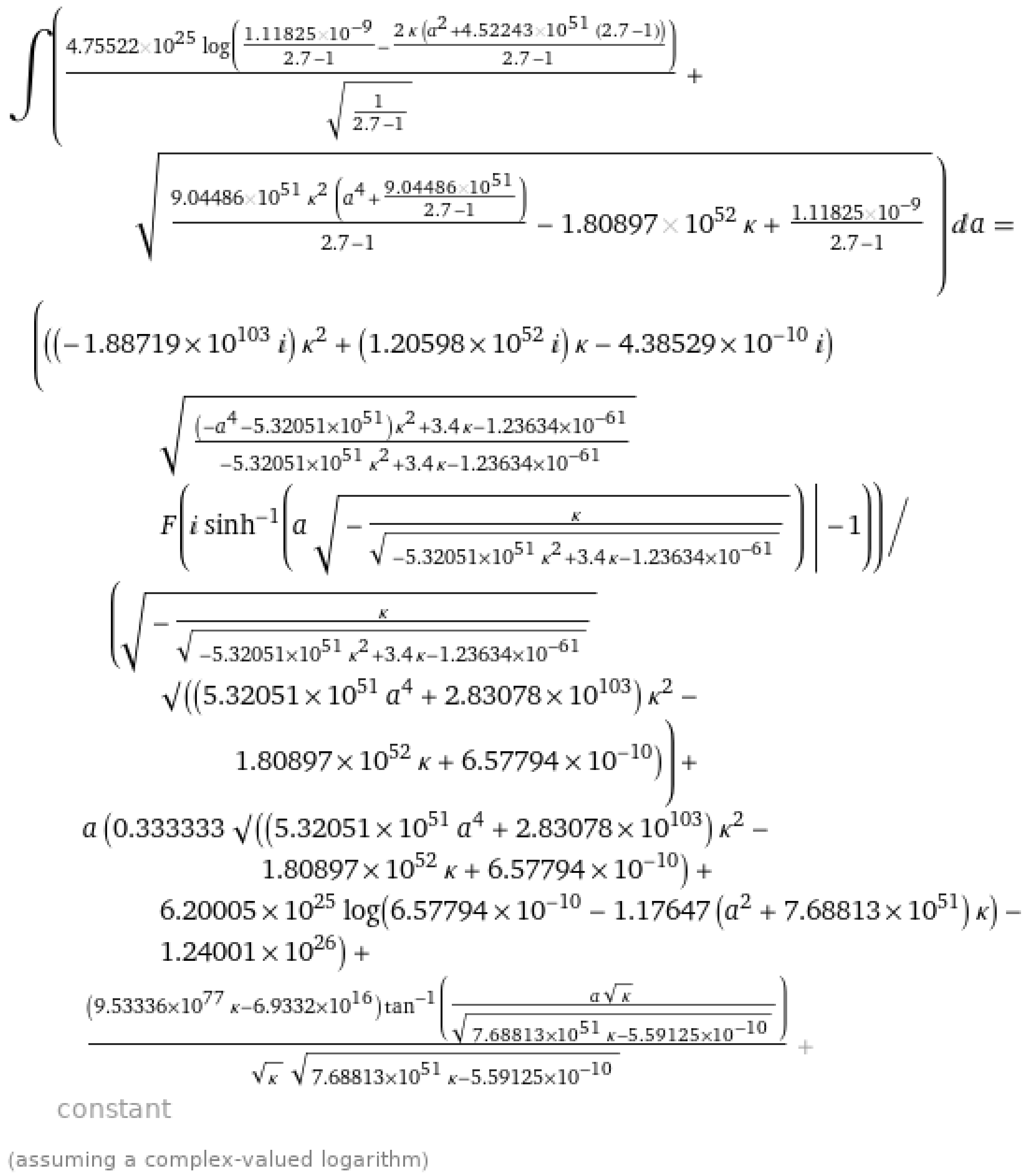
$$\left(\sqrt{2.83078\times 10^{103}\,\kappa^2-1.80897\times 10^{52}\,\kappa+6.57794\times 10^{-10}}+6.20005\times 10^{25}\log\left(6.57794\times 10^{-10}-9.04486\times 10^{51}\,\kappa\right)\right)-\frac{7.29417\times 10^{25}\,a^2\,\kappa}{6.57794\times 10^{-10}-9.04486\times 10^{51}\,\kappa}+O\left(a^4\right)$$

(Taylor series)

Derivative:

$$\frac{\partial}{\partial a}\left(\sqrt{\left(5\,320\,505\,882\,352\,940\,043\,367\,283\,894\,540\,087\,117\,777\,641\,389\,686\,784\left(a^4+5\,320\,505\,882\,352\,940\,043\,367\,283\,894\,540\,087\,117\,777\,641\,389\,686\,784\right)\kappa^2-18\,089\,700\,000\,000\,000\,035\,812\,972\,332\,161\,513\,655\,933\,168\,787\,652\,608\,\kappa+6.57794\times 10^{-10}\right)}+62\,000\,483\,322\,535\,474\,756\,583\,424\log\left(6.57794\times 10^{-10}-1.17647\left(a^2+7\,688\,131\,000\,000\,000\,516\,015\,078\,399\,174\,139\,989\,356\,129\,462\,255\,616\right)\kappa\right)\right)=a\,\kappa\left(\left(10\,641\,011\,764\,705\,880\,086\,734\,567\,789\,080\,174\,235\,555\,282\,779\,373\,568\,a^2\,\kappa\right)\Big/\left(\sqrt{\left(5\,320\,505\,882\,352\,940\,043\,367\,283\,894\,540\,087\,117\,777\,641\,389\,686\,784\left(a^4+5\,320\,505\,882\,352\,940\,043\,367\,283\,894\,540\,087\,117\,777\,641\,389\,686\,784\right)\kappa^2-18\,089\,700\,000\,000\,000\,035\,812\,972\,332\,161\,513\,655\,933\,168\,787\,652\,608\,\kappa+6.57794\times 10^{-10}\right)}\right)-145\,883\,490\,170\,671\,686\,108\,577\,792\Big/\left(6.57794\times 10^{-10}-1.17647\left(a^2+7\,688\,131\,000\,000\,000\,516\,015\,078\,399\,174\,139\,989\,356\,129\,462\,255\,616\right)\kappa\right)\right)$$

Indefinite integral:



$$\int\left(\frac{4.75522\times10^{25}\log\left(\frac{1.11825\times10^{-9}}{2.7-1}-\frac{2\kappa\left(a^2+4.52243\times10^{51}\,(2.7-1)\right)}{2.7-1}\right)}{\sqrt{\frac{1}{2.7-1}}}+\sqrt{\frac{9.04486\times10^{51}\,\kappa^2\left(a^4+\frac{9.04486\times10^{51}}{2.7-1}\right)}{2.7-1}-1.80897\times10^{52}\,\kappa+\frac{1.11825\times10^{-9}}{2.7-1}}\right)da=$$

$$\Bigg(\left(\left(-1.88719\times10^{103}\,i\right)\kappa^2+\left(1.20598\times10^{52}\,i\right)\kappa-4.38529\times10^{-10}\,i\right)$$
$$\sqrt{\frac{\left(-a^4-5.32051\times10^{51}\right)\kappa^2+3.4\,\kappa-1.23634\times10^{-61}}{-5.32051\times10^{51}\,\kappa^2+3.4\,\kappa-1.23634\times10^{-61}}}$$
$$F\left(i\sinh^{-1}\left(a\sqrt{-\frac{\kappa}{\sqrt{-5.32051\times10^{51}\,\kappa^2+3.4\,\kappa-1.23634\times10^{-61}}}}\right)\middle|-1\right)\Bigg)\Bigg/$$
$$\left(\sqrt{-\frac{\kappa}{\sqrt{-5.32051\times10^{51}\,\kappa^2+3.4\,\kappa-1.23634\times10^{-61}}}}\right.$$
$$\left.\sqrt{\left(\left(5.32051\times10^{51}\,a^4+2.83078\times10^{103}\right)\kappa^2-1.80897\times10^{52}\,\kappa+6.57794\times10^{-10}\right)}\right)+$$
$$a\left(0.333333\sqrt{\left(\left(5.32051\times10^{51}\,a^4+2.83078\times10^{103}\right)\kappa^2-1.80897\times10^{52}\,\kappa+6.57794\times10^{-10}\right)}+\right.$$
$$6.20005\times10^{25}\log\left(6.57794\times10^{-10}-1.17647\left(a^2+7.68813\times10^{51}\right)\kappa\right)-$$
$$\left.1.24001\times10^{26}\right)+$$
$$\frac{\left(9.53336\times10^{77}\,\kappa-6.9332\times10^{16}\right)\tan^{-1}\left(\frac{a\sqrt{\kappa}}{\sqrt{7.68813\times10^{51}\,\kappa-5.59125\times10^{-10}}}\right)}{\sqrt{\kappa}\,\sqrt{7.68813\times10^{51}\,\kappa-5.59125\times10^{-10}}}+$$
$$\text{constant}$$

(assuming a complex-valued logarithm)

sqrt(5.32051×10^51 (a^4 + 5.32051×10^51) 0.284079^2 - 1.80897×10^52 *0.284079 + 6.57794×10^-10) + 6.20005×10^25 log(6.57794×10^-10 - 1.17647 (a^2 + 7.68813×10^51) 0.284079)

Input interpretation:

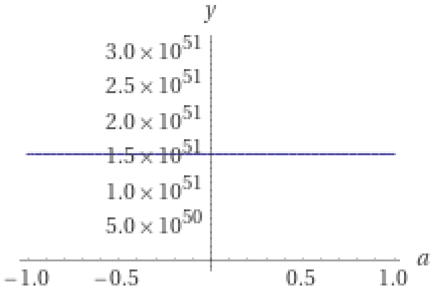
$$\sqrt{\left(5.32051\times 10^{51}\left(a^4+5.32051\times 10^{51}\right)\times 0.284079^2+1.80897\times 10^{52}\times(-0.284079)+6.57794\times 10^{-10}\right)}+6.20005\times 10^{25}\log\left(6.57794\times 10^{-10}+\left(a^2+7.68813\times 10^{51}\right)\times 0.284079\times(-1.17647)\right)$$

log(x) is the natural logarithm

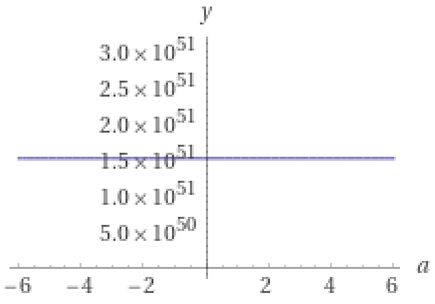
Result:

$$\sqrt{4.2937\times 10^{50}\left(a^4+5.32051\times 10^{51}\right)-5.1389\times 10^{51}}+6.20005\times 10^{25}\log\left(6.57794\times 10^{-10}-0.33421\left(a^2+7.68813\times 10^{51}\right)\right)$$

Plots:



(a from -1 to 1)



(a from -6 to 6)

Alternate forms:

$$\sqrt{4.2937\times 10^{50}\,a^4+2.28447\times 10^{102}}+6.20005\times 10^{25}\log\left(-0.33421\,a^2-2.56945\times 10^{51}\right)$$

$$\sqrt{4.2937\times 10^{50}\, a^4 + 2.28447\times 10^{102}} + 6.20005\times 10^{25}\log\left(-a^2 - 7.68813\times 10^{51}\right) - 6.79516\times 10^{25}$$

Alternate forms assuming a>0:

$$\sqrt{4.2937\times 10^{50}\, a^4 + 2.28447\times 10^{102}} + 6.20005\times 10^{25}\log\left(0.33421\, a^2 + 2.56945\times 10^{51}\right) + 1.9478\times 10^{26}\, i$$

$$\sqrt{4.2937\times 10^{50}\left(a^4 + 5.32051\times 10^{51}\right) - 5.1389\times 10^{51}} + 6.20005\times 10^{25}\left(\log\left(0.33421\left(a^2 + 7.68813\times 10^{51}\right) - 6.57794\times 10^{-10}\right) + i\,\pi\right)$$

Property as a function:

Parity

even

Series expansion at a=-6.03912×10<sup>12</sup>-6.03912×10<sup>12</sup> i:

$$\begin{aligned}&\left(7.33934\times 10^{27} + 2.23007\times 10^{43}\, i\right) - \\ &\quad \left(1.69626\times 10^{46} + 1.69626\times 10^{46}\, i\right)\left(a + \left(6.03912\times 10^{12} + 6.03912\times 10^{12}\, i\right)\right) - \\ &\quad \left(1.29022\times 10^{49} + 2.29536\times 10^{-52}\, i\right)\left(a + \left(6.03912\times 10^{12} + 6.03912\times 10^{12}\, i\right)\right)^2 - \\ &\quad \left(9.81381\times 10^{51} - 9.81381\times 10^{51}\, i\right)\left(a + \left(6.03912\times 10^{12} + 6.03912\times 10^{12}\, i\right)\right)^3 - \\ &\quad \left(5.24474\times 10^{-79} - 1.86617\times 10^{55}\, i\right)\left(a + \left(6.03912\times 10^{12} + 6.03912\times 10^{12}\, i\right)\right)^4 + \\ &\quad O\left(\left(a + \left(6.03912\times 10^{12} + 6.03912\times 10^{12}\, i\right)\right)^5\right)\end{aligned}$$

(Taylor series)

Series expansion at a=-6.03912×10<sup>12</sup>+6.03912×10<sup>12</sup> i:

$$\begin{aligned}&\left(7.33934\times10^{27}+2.23007\times10^{43}\,i\right)+\\&\quad\left(1.69626\times10^{46}-1.69626\times10^{46}\,i\right)\left(a+\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)+\\&\quad\left(1.29022\times10^{49}+2.29536\times10^{-52}\,i\right)\left(a+\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^2+\\&\quad\left(9.81381\times10^{51}+9.81381\times10^{51}\,i\right)\left(a+\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^3-\\&\quad\left(5.24474\times10^{-79}-1.86617\times10^{55}\,i\right)\left(a+\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^4+\\&\quad O\left(\left(a+\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^5\right)\end{aligned}$$

(Taylor series)

Series expansion at a=0:

$$\begin{cases}\left(1.51145\times10^{51}+0.14204\,a^4+O\left(a^6\right)\right)+\\\quad 6.20005\times10^{25}\left((118.376+3.14159\,i)+\right.\\\qquad\qquad \left.1.30071\times10^{-52}\,a^2-8.45919\times10^{-105}\,a^4+O\left(a^6\right)\right)^* & \operatorname{Im}\left(a^2\right)>0\\\left(1.51145\times10^{51}+1.9478\times10^{26}\,i\right)+\\\quad 8.06444\times10^{-27}\,a^2+0.14204\,a^4+O\left(a^6\right) & \text{(otherwise)}\end{cases}$$

Series expansion at a=-8.7682×10<sup>25</sup> i:

$$\begin{aligned}&\left(1.59308\times10^{77}+1.9478\times10^{26}\,i\right)+\left(3.63376\times10^{51}\,i\right)\left(a+8.7682\times10^{25}\,i\right)-\\&\quad\left(2.07212\times10^{25}+0\,i\right)\left(a+8.7682\times10^{25}\,i\right)^2+\\&\quad(0.00011338\,i)\left(a+8.7682\times10^{25}\,i\right)^3-\\&\quad\left(1.49975\times10^{-14}+0\,i\right)\left(a+8.7682\times10^{25}\,i\right)^4+O\left(\left(a+8.7682\times10^{25}\,i\right)^5\right)\end{aligned}$$

(Taylor series)

Series expansion at a=8.7682×10<sup>25</sup> i:

$$\begin{aligned}&\left(1.59308\times10^{77}+1.9478\times10^{26}\,i\right)-\left(3.63376\times10^{51}\,i\right)\left(a-8.7682\times10^{25}\,i\right)-\\&\quad\left(2.07212\times10^{25}+0\,i\right)\left(a-8.7682\times10^{25}\,i\right)^2-\\&\quad(0.00011338\,i)\left(a-8.7682\times10^{25}\,i\right)^3-\\&\quad\left(1.49975\times10^{-14}+0\,i\right)\left(a-8.7682\times10^{25}\,i\right)^4+O\left(\left(a-8.7682\times10^{25}\,i\right)^5\right)\end{aligned}$$

(Taylor series)

Series expansion at a=6.03912×10<sup>12</sup>-6.03912×10<sup>12</sup> i:

$$\begin{aligned}&\left(7.33934\times10^{27}+2.23007\times10^{43}\,i\right)-\\&\quad\left(1.69626\times10^{46}-1.69626\times10^{46}\,i\right)\left(a-\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)+\\&\quad\left(1.29022\times10^{49}+2.29536\times10^{-52}\,i\right)\left(a-\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^2-\\&\quad\left(9.81381\times10^{51}+9.81381\times10^{51}\,i\right)\left(a-\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^3-\\&\quad\left(5.24474\times10^{-79}-1.86617\times10^{55}\,i\right)\left(a-\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^4+\\&\quad O\left(\left(a-\left(6.03912\times10^{12}-6.03912\times10^{12}\,i\right)\right)^5\right)\end{aligned}$$

(Taylor series)

Series expansion at a=6.03912×10<sup>12</sup>+6.03912×10<sup>12</sup> i:

$$\begin{aligned}&\left(7.33934\times10^{27}+2.23007\times10^{43}\,i\right)+\\&\quad\left(1.69626\times10^{46}+1.69626\times10^{46}\,i\right)\left(a-\left(6.03912\times10^{12}+6.03912\times10^{12}\,i\right)\right)-\\&\quad\left(1.29022\times10^{49}+2.29536\times10^{-52}\,i\right)\left(a-\left(6.03912\times10^{12}+6.03912\times10^{12}\,i\right)\right)^2+\\&\quad\left(9.81381\times10^{51}-9.81381\times10^{51}\,i\right)\left(a-\left(6.03912\times10^{12}+6.03912\times10^{12}\,i\right)\right)^3-\\&\quad\left(5.24474\times10^{-79}-1.86617\times10^{55}\,i\right)\left(a-\left(6.03912\times10^{12}+6.03912\times10^{12}\,i\right)\right)^4+\\&\quad O\left(\left(a-\left(6.03912\times10^{12}+6.03912\times10^{12}\,i\right)\right)^5\right)\end{aligned}$$

(Taylor series)

Series expansion at a=∞:

$$2.07212\times10^{25}\,a^2+6.20005\times10^{25}\log\left(-0.33421\,a^2\right)+\frac{5.31792\times10^{77}}{a^2}+O\left(\left(\frac{1}{a}\right)^4\right)$$

(generalized Puiseux series)

Derivative:

$$\frac{d}{da}\left(\sqrt{(429\,369\,829\,690\,022\,976\,102\,335\,312\,974\,045\,250\,376\,876\,213\,403\,648\,(a^4 + 5\,320\,509\,999\,999\,999\,465\,950\,013\,290\,566\,902\,640\,362\,007\,319\,019\,520) - 5\,138\,903\,886\,300\,000\,292\,126\,897\,377\,052\,895\,766\,473\,584\,668\,573\,696)} + 62\,000\,500\,000\,000\,000\,313\,524\,224 \log\left(6.57794\times 10^{-10} - 0.33421\,(a^2 + 7\,688\,129\,999\,999\,999\,886\,311\,931\,367\,062\,559\,661\,770\,211\,491\,577\,856)\right)\right) =$$

$$\frac{124\,001\,000\,000\,000\,000\,627\,048\,448\,a}{a^2 + 7\,688\,129\,999\,999\,999\,886\,311\,931\,367\,062\,559\,661\,770\,211\,491\,577\,856} + (858\,739\,659\,380\,045\,952\,204\,670\,625\,948\,090\,500\,753\,752\,426\,807\,296\,a^3) \Big/ \left(\sqrt{(429\,369\,829\,690\,022\,976\,102\,335\,312\,974\,045\,250\,376\,876\,213\,403\,648\,a^4 + 2\,284\,466\,472\,564\,063\,785\,614\,722\,329\,850\,514\,735\,854\,407\,623\,425\,776\,748\,785\,927\,381\,448\,741\,501\,195\,120\,762\,040\,760\,830\,485\,929\,656\,320)}\right)$$

Indefinite integral:

$$\int\left(\sqrt{(5.32051\times 10^{51}\,(a^4 + 5.32051\times 10^{51})\,0.284079^2 - 1.80897\times 10^{52}\,0.284079 + 6.57794\times 10^{-10})} + 6.20005\times 10^{25} \log\left(6.57794\times 10^{-10} - 1.17647\,(a^2 + 7.68813\times 10^{51})\,0.284079\right)\right) da =$$

$$a\left(0.333333\sqrt{4.2937\times 10^{50}\,a^4 + 2.28447\times 10^{102}} + 6.20005\times 10^{25}\log\left(-a^2 - 7.68813\times 10^{51}\right) - 1.91953\times 10^{26}\right) - \left((9.19744\times 10^{114} + 9.19744\times 10^{114}\,i)\sqrt{1 - (1.37096\times 10^{-26}\,i)\,a^2}\sqrt{1 + (1.37096\times 10^{-26}\,i)\,a^2}\,F\left(i\sinh^{-1}\left((8.27936\times 10^{-14} + 8.27936\times 10^{-14}\,i)\,a\right)\,\middle|\,-1. + 0\,i\right)\right) \Big/ \left(\sqrt{4.2937\times 10^{50}\,a^4 + 2.28447\times 10^{102}}\right) + 1.08727\times 10^{52}\tan^{-1}\left(1.14049\times 10^{-26}\,a\right) + \text{constant}$$

(assuming a complex-valued logarithm)

For a = 1:

sqrt(5.32051×10^51 (1 + 5.32051×10^51) 0.284079^2 - 1.80897×10^52 *0.284079 + 6.57794×10^-10) + 6.20005×10^25 log(6.57794×10^-10 - 1.17647 (1 + 7.68813×10^51) 0.284079)

Input interpretation:

$$\sqrt{\left(5.32051\times10^{51}\left(1+5.32051\times10^{51}\right)\times0.284079^{2}+1.80897\times10^{52}\times(-0.284079)+6.57794\times10^{-10}\right)}+6.20005\times10^{25}\log\left(6.57794\times10^{-10}+\left(1+7.68813\times10^{51}\right)\times0.284079\times(-1.17647)\right)$$

log(x) is the natural logarithm

Result:

$1.51145\ldots\times10^{51}+$
$1.94780\ldots\times10^{26}\,i$

Polar coordinates:

$r = 1511445160289999833975151380956873473679656155611136$ (radius), $\theta = 1.2887\times10^{-25}$ (angle)

Scientific notation:

$1.511445160289999833975151380956873473679656155611136\times10^{51}$

$1.511445160289\ldots{}^{*}10^{51} = t$

For a = 6:

sqrt(((5.32051×10^51 (6^4 + 5.32051×10^51) 0.284079^2 - 1.80897×10^52 *0.284079 + 6.57794×10^-10))) + 6.20005×10^25 log(6.57794×10^-10 - 1.17647 (6^2 + 7.68813×10^51) 0.284079)

Input interpretation:

$$\sqrt{\left(5.32051\times10^{51}\left(6^{4}+5.32051\times10^{51}\right)\times0.284079^{2}+1.80897\times10^{52}\times(-0.284079)+6.57794\times10^{-10}\right)}+6.20005\times10^{25}\log\left(6.57794\times10^{-10}+\left(6^{2}+7.68813\times10^{51}\right)\times0.284079\times(-1.17647)\right)$$

log(x) is the natural logarithm

Result:

$1.51145\ldots \times 10^{51}$ +
$1.94780\ldots \times 10^{26}\, i$

Polar coordinates:

$r = 1\,511\,445\,160\,289\,999\,833\,975\,151\,380\,956\,873\,473\,679\,656\,155\,611\,136$
(radius), $\theta = 1.2887\times 10^{-25}$ (angle)

Result:

$1.511445160289999833975151380956873473679656155611136\times 10^{51}$
$1.511445160289\ldots.*10^{51} = t$

From:

$$t_0 = t_f\sqrt{1-\frac{2GM}{rc^2}} = t_f\sqrt{1-\frac{r_0}{r}}$$

(1.51145e+51+1.94780e+26i) = sqrt(1-(2*6.67408e-11*x)/(299792458^2))

Input interpretation

$$1.51145\times 10^{51} + 1.94780\times 10^{26}\, i = \sqrt{1-\frac{2\times 6.67408\times 10^{-11}\, x}{299\,792\,458^2}}$$

i is the imaginary unit

Result

$$1.51145\times 10^{51} + 1.9478\times 10^{26}\, i = \sqrt{1-1.48518\times 10^{-27}\, x}$$

Complex solution

$x =$
$-1\,538\,181\,458\,416\,942\,584\,033\,767\,111\,261\,284\,915\,484\,484\,936\,671\,134\,916\,871\ddots$
$665\,826\,612\,217\,610\,608\,672\,194\,126\,488\,057\,390\,579\,144\,583\,155\,090\,607\ddots$
$340\,837\,192\,926\,756\,864 -$
$396\,449\,746\,231\,039\,142\,290\,793\,440\,272\,648\,396\,787\,768\,337\,145\,959\,476\,842\ddots$
$947\,273\,462\,428\,010\,821\,551\,664\,761\,458\,726\,040\,030\,211\,473\,408\, i$

-1.53818145841694258403376711112×10^129 - 3.96449746231039142290793440272×10^104i

Input interpretation

$$-(1.53818145841694258403376711112\times10^{129}) - (3.96449746231039142290793440272\times10^{104})\,i$$

i is the imaginary unit

Result

$$-1.53818145841694258403376711112\ldots\times10^{129} - 3.9644974623103914229079344027\ldots\times10^{104}\,i$$

Polar coordinates

$r =$ 1 538 181 458 416 942 584 033 767 111 199 999 999 999 546 458 680 294 249 329⋱ 957 191 477 543 440 510 863 073 764 888 546 590 847 216 310 382 804 911 921⋱ 436 154 608 484 352 (radius),

$\theta = -3.14159265358979323846264312554024587933430719976932447$ (angle)

Decimal approximation

$$1.5381814584169425840337671111999999999995464586802942493299\ldots\times10^{129}$$

$1.53818145841*10^{129} = M$

From the above result, after some calculations, we obtain:

(1+0.9568666373)((sqrt(1.53818145841*10^129)*1/299792458)) grams

Input interpretation

$$(1+0.9568666373)\times\sqrt{1.53818145841\times10^{129}}\times\frac{1}{299\,792\,458}\text{ grams}$$

Result

$2.560025623 \times 10^{56}$ grams

$2.560025623*10^{56}$ g ≈ Mass of the Universe

Unit conversions

$2.560025623 \times 10^{53}$ kg (kilograms)

5.6438904×10^{53} lb (pounds)

$2.560025623 \times 10^{50}$ t (metric tons)

Comparisons as mass

≈ universe mass ($\approx 2 \times 10^{53}$ kg)

≈ 900 × low end for estimated mass of the universe ($\approx 3 \times 10^{50}$ kg)

Interpretations

mass

Input interpretation

universe mass

Value

$\approx 2 \times 10^{53}$ kg (kilograms)

$\approx 2 \times 10^{56}$ grams

Mass ≈ 2 * 10^{56} grams

≈ 3×10^{53} lb (pounds)

Comparison

≈ 500 × low end for estimated mass of the universe (≈ 3×10^{50} kg)

Interpretation

mass

From the previous results, we obtain also, after some calculations:

(27+ ((((√(10-2√5) -2))⁄((√5-1))))^2) * (((1.53818145841*10^129) / (299792458)))

Input interpretation

$$\left(27+\left(\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)^2\right)\times\frac{1.53818145841\times10^{129}}{299\,792\,458}$$

Result

$1.38946230629\ldots\times10^{122}$

1.38946230629….*10^{122} result almost equal to the value of Planck intensity 1.388923×10^{122} , i.e.:

$$i_{\mathrm{P}}=\rho_{\mathrm{P}}^{E}c=\frac{P_{\mathrm{P}}}{l_{\mathrm{P}}^{2}}=\frac{c^{8}}{\hbar G^{2}}$$

And:

((7+ ((((√(10-2√5) -2))/((√5-1))))^(sqrt(2/3))))((1.53818145841*10^129) /(1.511445160289*10^51))

Input interpretation

$$\left(7+\left(\frac{\sqrt{10-2\sqrt{5}}-2}{\sqrt{5}-1}\right)^{\sqrt{2/3}}\right)\times\frac{1.53818145841\times10^{129}}{1.511445160289\times10^{51}}$$

Result

$7.48803315832\ldots\times10^{78}$

$7.48803315832\ldots*10^{78}$ result very near to the value of Planck surface tension 7.488024×10^{78} , i.e.:

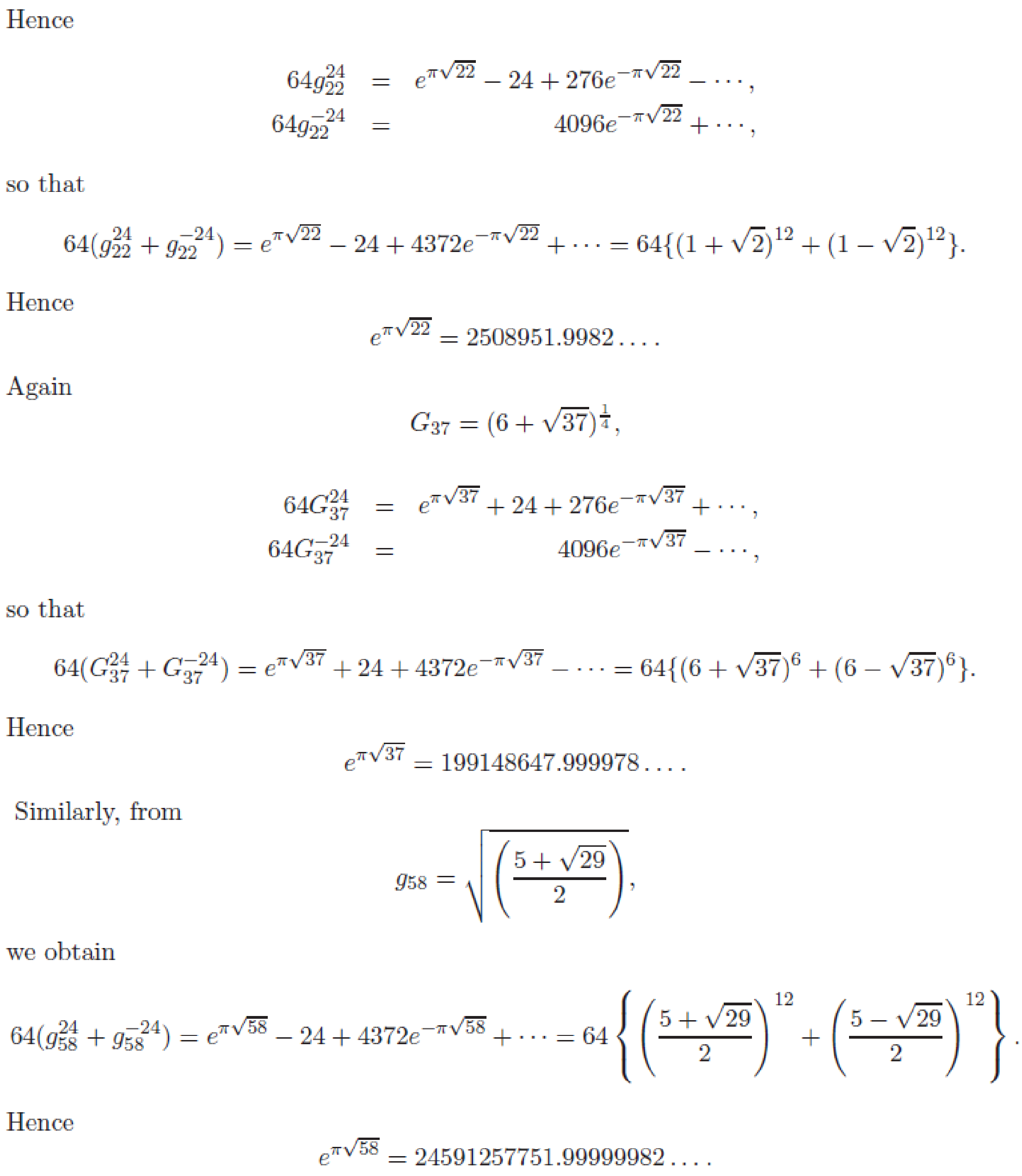
$$\frac{F_P}{l_P}=\sqrt{\frac{c^{11}}{\hbar G^3}}$$

Mathematical connections with some sectors of String Theory

From:

Modular equations and approximations to π - *Srinivasa Ramanujan*
Quarterly Journal of Mathematics, XLV, 1914, 350 – 372

We have that:



Hence

$$\begin{aligned} 64g_{22}^{24} &= e^{\pi\sqrt{22}} - 24 + 276e^{-\pi\sqrt{22}} - \cdots, \\ 64g_{22}^{-24} &= 4096e^{-\pi\sqrt{22}} + \cdots, \end{aligned}$$

so that

$$64(g_{22}^{24} + g_{22}^{-24}) = e^{\pi\sqrt{22}} - 24 + 4372e^{-\pi\sqrt{22}} + \cdots = 64\{(1+\sqrt{2})^{12} + (1-\sqrt{2})^{12}\}.$$

Hence

$$e^{\pi\sqrt{22}} = 2508951.9982\ldots.$$

Again

$$G_{37} = (6+\sqrt{37})^{\frac{1}{4}},$$

$$\begin{aligned} 64G_{37}^{24} &= e^{\pi\sqrt{37}} + 24 + 276e^{-\pi\sqrt{37}} + \cdots, \\ 64G_{37}^{-24} &= 4096e^{-\pi\sqrt{37}} - \cdots, \end{aligned}$$

so that

$$64(G_{37}^{24} + G_{37}^{-24}) = e^{\pi\sqrt{37}} + 24 + 4372e^{-\pi\sqrt{37}} - \cdots = 64\{(6+\sqrt{37})^{6} + (6-\sqrt{37})^{6}\}.$$

Hence

$$e^{\pi\sqrt{37}} = 199148647.999978\ldots.$$

Similarly, from

$$g_{58} = \sqrt{\left(\frac{5+\sqrt{29}}{2}\right)},$$

we obtain

$$64(g_{58}^{24} + g_{58}^{-24}) = e^{\pi\sqrt{58}} - 24 + 4372e^{-\pi\sqrt{58}} + \cdots = 64\left\{\left(\frac{5+\sqrt{29}}{2}\right)^{12} + \left(\frac{5-\sqrt{29}}{2}\right)^{12}\right\}.$$

Hence

$$e^{\pi\sqrt{58}} = 24591257751.99999982\ldots.$$

From:

An Update on Brane Supersymmetry Breaking
J. Mourad and A. Sagnotti - arXiv:1711.11494v1 [hep-th] 30 Nov 2017

From the following vacuum equations:

$$T\,e^{\gamma_E\,\phi} \;=\; -\,\frac{\beta_E^{(p)}\,h^2}{\gamma_E}\;e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}$$

$$16\,k'\,e^{-\,2\,C} \;=\; \frac{h^2\left(p\,+\,1\,-\,\frac{2\,\beta_E^{(p)}}{\gamma_E}\right)e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}}{(7\,-\,p)}$$

$$(A')^2 \;=\; k\,e^{-\,2\,A} \,+\, \frac{h^2}{16(p\,+\,1)}\left(7\,-\,p\,+\,\frac{2\,\beta_E^{(p)}}{\gamma_E}\right)e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}$$

we have obtained, from the results almost equals of the equations, putting

$4096\,e^{-\pi\sqrt{18}}$ instead of

$$e^{-\,2\,(8\,-\,p)\,C\,+\,2\,\beta_E^{(p)}\,\phi}$$

a new possible mathematical connection between the two exponentials. Thence, also the values concerning p, C, β_E and ϕ correspond to the exponents of e (i.e. of exp). Thence we obtain for p = 5 and β_E = 1/2:

$$e^{-6C+\phi} = 4096e^{-\pi\sqrt{18}}$$

Therefore, with respect to the exponentials of the vacuum equations, the Ramanujan's exponential has a coefficient of 4096 which is equal to 642, while -6C+ϕ is equal to -$\pi\sqrt{18}$. From this it follows that it is possible to establish mathematically, the dilaton value.

For

exp((-Pi*sqrt(18))   we obtain:

Input:

$$\exp\left(-\pi\sqrt{18}\right)$$

Exact result:

$$e^{-3\sqrt{2}\,\pi}$$

Decimal approximation:

$$1.6272016226072509292942156739117979541838581136954016\ldots\times 10^{-6}$$

$1.6272016\ldots * 10^{-6}$

Property:

$e^{-3\sqrt{2}\,\pi}$ is a transcendental number

Series representations:

$$e^{-\pi\sqrt{18}} = e^{-\pi\sqrt{17}\sum_{k=0}^{\infty} 17^{-k}\binom{1/2}{k}}$$

$$e^{-\pi\sqrt{18}} = \exp\left(-\pi\sqrt{17}\sum_{k=0}^{\infty}\frac{\left(-\frac{1}{17}\right)^k\left(-\frac{1}{2}\right)_k}{k!}\right)$$

$$e^{-\pi\sqrt{18}} = \exp\left(-\frac{\pi\sum_{j=0}^{\infty}\operatorname{Res}_{s=-\frac{1}{2}+j} 17^{-s}\,\Gamma\left(-\frac{1}{2}-s\right)\Gamma(s)}{2\sqrt{\pi}}\right)$$

Now, we have the following calculations:

$$e^{-6C+\phi} = 4096 e^{-\pi\sqrt{18}}$$

$e^{-\pi\sqrt{18}}$ = 1.6272016… * 10^-6

from which:

$\frac{1}{4096} e^{-6C+\phi}$ = 1.6272016… * 10^-6

0.000244140625 $e^{-6C+\phi}$ = $e^{-\pi\sqrt{18}}$ = 1.6272016… * 10^-6

Now:

$$\ln\left(e^{-\pi\sqrt{18}}\right) = -13.328648814475 = -\pi\sqrt{18}$$

And:

(1.6272016* 10^-6) *1/ (0.000244140625)

Input interpretation:

$$\frac{1.6272016}{10^6} \times \frac{1}{0.000244140625}$$

Result:

0.0066650177536

0.006665017...

Thence:

$$0.000244140625\, e^{-6C+\phi} = e^{-\pi\sqrt{18}}$$

Dividing both sides by 0.000244140625, we obtain:

$$\frac{0.000244140625}{0.000244140625}\, e^{-6C+\phi} = \frac{1}{0.000244140625}\, e^{-\pi\sqrt{18}}$$

$$e^{-6C+\phi} = 0.0066650177536$$

((((exp((-Pi*sqrt(18)))))))*1/0.000244140625

Input interpretation:

$$\exp\left(-\pi \sqrt{18}\right) \times \frac{1}{0.000244140625}$$

Result:

0.00666501785…

0.00666501785…

Series representations:

$$\frac{\exp(-\pi \sqrt{18})}{0.000244141} = 4096 \exp\left(-\pi \sqrt{17} \sum_{k=0}^{\infty} 17^{-k} \binom{\frac{1}{2}}{k}\right)$$

$$\frac{\exp(-\pi \sqrt{18})}{0.000244141} = 4096 \exp\left(-\pi \sqrt{17} \sum_{k=0}^{\infty} \frac{\left(-\frac{1}{17}\right)^k \left(-\frac{1}{2}\right)_k}{k!}\right)$$

$$\frac{\exp(-\pi \sqrt{18})}{0.000244141} = 4096 \exp\left(-\frac{\pi \sum_{j=0}^{\infty} \operatorname{Res}_{s=-\frac{1}{2}+j} 17^{-s}\, \Gamma\left(-\frac{1}{2} - s\right) \Gamma(s)}{2 \sqrt{\pi}}\right)$$

Now:

$$e^{-6C+\phi} = 0.0066650177536$$

$$\exp\left(-\pi\sqrt{18}\right)\times\frac{1}{0.000244140625} =$$

$$e^{-\pi\sqrt{18}}\times\frac{1}{0.000244140625}$$

$$= 0.00666501785\ldots$$

From:

ln(0.00666501784619)

Input interpretation:

$\log(0.00666501784619)$

Result:

$-5.010882647757\ldots$

-5.010882647757…

Alternative representations:

$$\log(0.006665017846190000) = \log_e(0.006665017846190000)$$

$$\log(0.006665017846190000) = \log(a)\log_a(0.006665017846190000)$$

$$\log(0.006665017846190000) = -\text{Li}_1(0.993334982153810000)$$

Series representations:

$$\log(0.00666501784619000) = -\sum_{k=1}^{\infty} \frac{(-1)^k (-0.99333498215381000)^k}{k}$$

$$\log(0.00666501784619000) = 2 i \pi \left\lfloor \frac{\arg(0.00666501784619000 - x)}{2 \pi} \right\rfloor + \log(x) - \sum_{k=1}^{\infty} \frac{(-1)^k (0.00666501784619000 - x)^k x^{-k}}{k} \quad \text{for } x < 0$$

$$\log(0.00666501784619000) = \left\lfloor \frac{\arg(0.00666501784619000 - z_0)}{2 \pi} \right\rfloor \log\left(\frac{1}{z_0}\right) + \log(z_0) + \left\lfloor \frac{\arg(0.00666501784619000 - z_0)}{2 \pi} \right\rfloor \log(z_0) - \sum_{k=1}^{\infty} \frac{(-1)^k (0.00666501784619000 - z_0)^k z_0^{-k}}{k}$$

Integral representation:

$$\log(0.00666501784619000) = \int_1^{0.00666501784619000} \frac{1}{t} \, dt$$

In conclusion:

$$-6C + \phi = -5.010882647757 \ldots$$

and for C = 1, we obtain:

$\phi = -5.010882647757 + 6 = \mathbf{0.989117352243} = \boldsymbol{\phi}$

Note that the values of n_s (spectral index) 0.965, of the average of the Omega mesons Regge slope 0.987428571 and of the dilaton 0.989117352243, are also connected to the following two Rogers-Ramanujan continued fractions:

$$\frac{e^{-\frac{\pi}{5}}}{\sqrt{(\varphi-1)\sqrt{5}}-\varphi+1}=1-\cfrac{e^{-\pi}}{1+\cfrac{e^{-2\pi}}{1+\cfrac{e^{-3\pi}}{1+\cfrac{e^{-4\pi}}{1+\ldots}}}}\approx 0.9568666373$$

$$\frac{e^{-\frac{\pi}{\sqrt{5}}}}{\frac{\sqrt{5}}{1+\sqrt[5]{\sqrt{\varphi^5\sqrt[4]{5^3}}-1}}-\varphi+1}=1-\cfrac{e^{-\pi\sqrt{5}}}{1+\cfrac{e^{-2\pi\sqrt{5}}}{1+\cfrac{e^{-3\pi\sqrt{5}}}{1+\cfrac{e^{-4\pi\sqrt{5}}}{1+\ldots}}}}\approx 0.9991104684$$

(http://www.bitman.name/math/article/102/109/)

The mean between the two results of the above Rogers-Ramanujan continued fractions is 0.97798855285, value very near to the ψ Regge slope 0.979:

Ψ	3	$m_c = 1500$	0.979	-0.09

Also performing the 512th root of the inverse value of the Pion meson rest mass 139.57, we obtain:

((1/(139.57)))^1/512

Input interpretation:

$$\sqrt[512]{\frac{1}{139.57}}$$

Result:

0.99040073270864402755097375571330141546073279617855551684...

0.99040073.... result very near to the dilaton value $\mathbf{0.989117352243} = \boldsymbol{\phi}$ and to the value of the following Rogers-Ramanujan continued fraction:

$$\frac{e^{-\frac{\pi}{\sqrt{5}}}}{\frac{\sqrt{5}}{1+\sqrt[5]{\sqrt{\varphi^5\sqrt[4]{5^3}}-1}}-\varphi+1}=1-\frac{e^{-\pi\sqrt{5}}}{1+\frac{e^{-2\pi\sqrt{5}}}{1+\frac{e^{-3\pi\sqrt{5}}}{1+\frac{e^{-4\pi\sqrt{5}}}{1+\ldots}}}}\approx 0.9991104684$$

From

AdS Vacua from Dilaton Tadpoles and Form Fluxes - *J. Mourad and A. Sagnotti* - arXiv:1612.08566v2 [hep-th] 22 Feb 2017 - March 27, 2018

We have:

$$\begin{aligned} e^{2C} &= \frac{2\,\xi\, e^{\frac{\phi}{2}}}{1 \pm \sqrt{1-\frac{\xi T}{3}\, e^{2\phi}}} \\ \frac{h^2}{32} &= \frac{\xi^7\, e^{4\phi}}{\left(1 \pm \sqrt{1-\frac{\xi T}{3}\, e^{2\phi}}\right)^7}\left[\frac{42}{\xi}\left(1 \pm \sqrt{1-\frac{\xi T}{3}\, e^{2\phi}}\right) + 5\,T\, e^{2\phi}\right] . \qquad (2.7) \end{aligned}$$

For

$T = \frac{16}{\pi^2}$

$\xi = 1$

we obtain:

(2*e^(0.989117352243/2)) / (1+sqrt(((1-1/3*16/(Pi)^2*e^(2*0.989117352243)))))

Input interpretation:

$$\frac{2\,e^{0.989117352243/2}}{1+\sqrt{1-\frac{1}{3}\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}}}$$

Result:

$0.83941881822\ldots -$
$1.4311851867\ldots\, i$

Polar coordinates:

$r = 1.65919106525$ (radius), $\theta = -59.607521917°$ (angle)

1.65919106525….. result very near to the 14th root of the following Ramanujan’s class invariant $Q = \left(G_{505}/G_{101/5}\right)^3 = 1164.2696$ i.e. 1.65578...

Series representations:

$$\frac{2\,e^{0.98911735224300000/2}}{1+\sqrt{1-\frac{16\,e^{2\times 0.98911735224300000}}{3\,\pi^2}}} = \frac{2\,e^{0.49455867612150000}}{1+\sqrt{-\frac{16\,e^{1.97823470448600000}}{3\,\pi^2}}\;\sum_{k=0}^{\infty}\left(\frac{3}{16}\right)^k\left(-\frac{e^{1.97823470448600000}}{\pi^2}\right)^{-k}\binom{\frac{1}{2}}{k}}$$

$$\frac{2\,e^{0.98911735224300000/2}}{1+\sqrt{1-\frac{16\,e^{2\times 0.98911735224300000}}{3\,\pi^2}}} = \frac{2\,e^{0.49455867612150000}}{1+\sqrt{-\frac{16\,e^{1.97823470448600000}}{3\,\pi^2}}\;\sum_{k=0}^{\infty}\frac{\left(-\frac{3}{16}\right)^k\left(-\frac{e^{1.97823470448600000}}{\pi^2}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}}$$

$$\frac{2\,e^{0.98911735224300000/2}}{1+\sqrt{1-\frac{16\,e^{2\times 0.98911735224300000}}{3\,\pi^2}}} =$$

$$\frac{2\,e^{0.49455867612150000}}{1+\sqrt{z_0}\,\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}-z_0\right)^k z_0^{-k}}{k!}}$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

From

$$\frac{h^2}{32} = \frac{\xi^7\,e^{4\phi}}{\left(1 \pm \sqrt{1-\frac{\xi T}{3}\,e^{2\phi}}\right)^7}\left[\frac{42}{\xi}\left(1 \pm \sqrt{1-\frac{\xi T}{3}\,e^{2\phi}}\right) + 5\,T\,e^{2\phi}\right]$$

we obtain:

e^(4*0.989117352243) / (((1+sqrt(1-1/3*16/(Pi)^2*e^(2*0.989117352243)))))^7 [42(1+sqrt(1-1/3*16/(Pi)^2*e^(2*0.989117352243))+5*16/(Pi)^2*e^(2*0.989117352243)]

Input interpretation:

$$\frac{e^{4\times 0.989117352243}}{\left(1+\sqrt{1-\frac{1}{3}\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1-\frac{1}{3}\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}}\right)+5\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}\right)$$

Result:

50.84107889… −
20.34506335… i

Polar coordinates:

$r = 54.76072411$ (radius), $\theta = -21.80979492°$ (angle)

54.76072411…..

Series representations:

$$\left(\left(42\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)+\frac{5\times 16\,e^{2\times 0.9891173522430000}}{\pi^2}\right)e^{4\times 0.9891173522430000}\right)\Big/\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)^7=\left(2\left(40\,e^{5.934704113458000}+21\,e^{3.956469408972000}\,\pi^2+21\,e^{3.956469408972000}\,\pi^2\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\left(\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\binom{\frac{1}{2}}{k}\right)\right)\Big/\left(\pi^2\left(1+\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\left(\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\binom{\frac{1}{2}}{k}\right)^7\right)$$

$$\left(\left(42\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)+\frac{5\times 16\,e^{2\times 0.9891173522430000}}{\pi^2}\right)e^{4\times 0.9891173522430000}\right)\Big/\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)^7=\left(2\left(40\,e^{5.934704113458000}+21\,e^{3.956469408972000}\,\pi^2+21\,e^{3.956469408972000}\,\pi^2\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\frac{\left(-\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\right)\Big/\left(\pi^2\left(1+\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\frac{\left(-\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)$$

$$\left(\left(42\left(1+\sqrt{1-\frac{16\,e^{2\times 0.98911735224300000}}{3\,\pi^2}}\right)+\frac{5\times 16\,e^{2\times 0.98911735224300000}}{\pi^2}\right)e^{4\times 0.98911735224300000}\right)\Big/\left(1+\sqrt{1-\frac{16\,e^{2\times 0.98911735224300000}}{3\,\pi^2}}\right)^7 =$$

$$\left(2\left(40\,e^{5.934704113458000}+21\,e^{3.956469408972000}\,\pi^2+21\,e^{3.956469408972000}\,\pi^2\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}-z_0\right)^k z_0^{-k}}{k!}\right)\right)\Big/\left(\pi^2\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}-z_0\right)^k z_0^{-k}}{k!}\right)^7\right)$$

for $(\text{not } (z_0 \in \mathbb{R} \text{ and } -\infty < z_0 \leq 0))$

From which:

e^(4*0.989117352243) / (((1+sqrt(1-1/3*16/(Pi)^2*e^(2*0.989117352243)))))^7 [42(1+sqrt(1-1/3*16/(Pi)^2*e^(2*0.989117352243)))+5*16/(Pi)^2*e^(2*0.989117352243)]*1/34

Input interpretation:

$$\frac{e^{4\times 0.989117352243}}{\left(1+\sqrt{1-\frac{1}{3}\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1-\frac{1}{3}\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}}\right)+5\times\frac{16}{\pi^2}\,e^{2\times 0.989117352243}\right)\times\frac{1}{34}$$

Result:

$1.495325850\ldots -$
$0.5983842161\ldots\, i$

Polar coordinates:

$r = 1.610609533$ (radius), $\theta = -21.80979492°$ (angle)

1.610609533…. result that is a good approximation to the value of the golden ratio 1.618033988749...

Series representations:

$$\left(\left(\left(42\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)+\frac{5\times 16\,e^{2\times 0.9891173522430000}}{\pi^2}\right)e^{4\times 0.9891173522430000}\right)\Big/\left(34\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)^7\right)\right)=$$
$$\left(40\,e^{5.934704113458000}+21\,e^{3.956469408972000}\,\pi^2+21\,e^{3.956469408972000}\,\pi^2\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\left(\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\binom{\frac{1}{2}}{k}\right)\Big/$$
$$\left(17\,\pi^2\left(1+\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\left(\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\binom{\frac{1}{2}}{k}\right)^7\right)$$

$$\left(\left(\left(42\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)+\frac{5\times 16\,e^{2\times 0.9891173522430000}}{\pi^2}\right)e^{4\times 0.9891173522430000}\right)\Big/\left(34\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)^7\right)\right)=$$
$$\left(40\,e^{5.934704113458000}+21\,e^{3.956469408972000}\,\pi^2+21\,e^{3.956469408972000}\,\pi^2\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\frac{\left(-\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\Big/$$
$$\left(17\,\pi^2\left(1+\sqrt{-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}}\sum_{k=0}^{\infty}\frac{\left(-\frac{3}{16}\right)^k\left(-\frac{e^{1.978234704486000}}{\pi^2}\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)$$

$$\left(\left(42\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)+\frac{5\times 16\,e^{2\times 0.9891173522430000}}{\pi^2}\right) e^{4\times 0.9891173522430000}\right)\Big/\left(34\left(1+\sqrt{1-\frac{16\,e^{2\times 0.9891173522430000}}{3\,\pi^2}}\right)^7\right)=$$

$$\left(40\,e^{5.934704113458000}+21\,e^{3.956469408972000}\,\pi^2+21\,e^{3.956469408972000}\,\pi^2\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}-z_0\right)^k z_0^{-k}}{k!}\right)\Big/\left(17\,\pi^2\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1-\frac{16\,e^{1.978234704486000}}{3\,\pi^2}-z_0\right)^k z_0^{-k}}{k!}\right)^7\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \le 0$))

Now, we have:

$$e^{2C} = \frac{2\,\xi\,e^{-\frac{\phi}{2}}}{1+\sqrt{1+\frac{\xi\Lambda}{3}\,e^{2\phi}}}\,, \tag{2.9}$$

$$\frac{h^2}{32} = \frac{e^{-4\phi}}{\left[1+\sqrt{1+\frac{\Lambda}{3}\,e^{2\phi}}\right]^7}\left[42\left(1+\sqrt{1+\frac{\Lambda}{3}\,e^{2\phi}}\right)-13\,\Lambda\,e^{2\phi}\right]. \tag{2.10}$$

For:

$\xi = 1$

$\Lambda \simeq \frac{4\pi^2}{25}$

$\phi = 0.989117352243$

From

$$e^{2C} = \frac{2\xi e^{-\frac{\phi}{2}}}{1 + \sqrt{1 + \frac{\xi\Lambda}{3} e^{2\phi}}},$$

we obtain:

((2*e^(-0.989117352243/2))) /
((((1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243)))))))

Input interpretation:

$$\frac{2 e^{-0.989117352243/2}}{1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}}$$

Result:

0.382082347529...

0.382082347529….

Series representations:

$$\frac{2 e^{-0.98911735224300000/2}}{1+\sqrt{1+\frac{\left(4\pi^2\right)e^{2\times 0.98911735224300000}}{3\times 25}}} = 2\Bigg/\left(e^{0.494558676121500000}\left(1+\sqrt{\frac{4 e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)\right)$$

$$\frac{2 e^{-0.98911735224300000/2}}{1+\sqrt{1+\frac{\left(4\pi^2\right)e^{2\times 0.98911735224300000}}{3\times 25}}} = 2\Bigg/\left(e^{0.494558676121500000}\left(1+\sqrt{\frac{4 e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\right)$$

$$\frac{2\,e^{-0.98911735224300000/2}}{1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.98911735224300000}}{3\times 25}}} = \frac{2}{e^{0.49455867612150000}\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.97823470448600000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)}$$

for (not $(z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0))$

From which:

1+1/(((4((2*e^(-0.989117352243/2))) / ((((1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))))))))

Input interpretation:

$$1+\frac{1}{4\times\frac{2\,e^{-0.989117352243/2}}{1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}}}}$$

Result:

1.65430921270...

1.6543092….. We note that, the result 1.6543092... is very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3 = 1164.2696$ i.e. 1.65578...

Indeed:

$$G_{505}=P^{-1/4}Q^{1/6}=(\sqrt{5}+2)^{1/2}\left(\frac{\sqrt{5}+1}{2}\right)^{1/4}(\sqrt{101}+10)^{1/4}$$
$$\times\left((130\sqrt{5}+29\sqrt{101})+\sqrt{169440+7540\sqrt{505}}\right)^{1/6}.$$

Thus, it remains to show that

$$(130\sqrt{5}+29\sqrt{101})+\sqrt{169440+7540\sqrt{505}}=\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3,$$

which is straightforward. ☐

$$\sqrt[14]{\left(\sqrt{\frac{113+5\sqrt{505}}{8}}+\sqrt{\frac{105+5\sqrt{505}}{8}}\right)^3}=1{,}65578\ldots$$

Series representations:

$$1+\frac{1}{\frac{4\left(2\,e^{-0.98911735224 30000/2}\right)}{1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.98911735224 30000}}{3\times 25}}}}=$$
$$1+\frac{e^{0.4945586761215000}}{8}+\frac{1}{8}\,e^{0.4945586761215000}\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}$$

$$1+\frac{1}{\frac{4\left(2\,e^{-0.98911735224 30000/2}\right)}{1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.98911735224 30000}}{3\times 25}}}}=$$
$$1+\frac{e^{0.4945586761215000}}{8}+\frac{1}{8}\,e^{0.4945586761215000}\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

$$1+\frac{1}{\frac{4\left(2\,e^{-0.98911735224300000/2}\right)}{1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.98911735224300000}}{3\times 25}}}}=1+\frac{e^{0.4945586761215000}}{8}+$$

$$\frac{1}{8}\,e^{0.4945586761215000}\,\sqrt{z_0}\,\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}$$

$$\text{for }(\text{not }(z_0\in\mathbb{R}\text{ and }-\infty<z_0\leq 0))$$

And from

$$\frac{h^2}{32}=\frac{e^{-4\phi}}{\left[1+\sqrt{1+\frac{\Lambda}{3}\,e^{2\phi}}\right]^7}\left[42\left(1+\sqrt{1+\frac{\Lambda}{3}\,e^{2\phi}}\right)-13\,\Lambda\,e^{2\phi}\right].$$

we obtain:

e^(-4*0.989117352243) / [1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243)))]^7 * [42(1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243)))-13*(4Pi^2)/25*e^(2*0.989117352243)]

Input interpretation:

$$\frac{e^{-4\times 0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\,(4\,\pi^2)\right)e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\,(4\,\pi^2)\right)e^{2\times 0.989117352243}}\right)-13\left(\frac{1}{25}\,(4\,\pi^2)\right)e^{2\times 0.989117352243}\right)$$

Result:

−0.034547055658…

-0.034547055658…

Series representations:

$$\left(\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}\,(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right) e^{-4\times 0.9891173522430000}\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7 = -\left(\left(42\left(-25\,e^{1.978234704486000}+52\,e^{3.956469408972000}\,\pi^2-25\,e^{1.978234704486000}\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)\right)\Big/\left(25\,e^{5.934704113458000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)^7\right)\right)$$

$$\left(\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}\,(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right) e^{-4\times 0.9891173522430000}\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7 = -\left(\left(42\left(-25\,e^{1.978234704486000}+52\,e^{3.956469408972000}\,\pi^2-25\,e^{1.978234704486000}\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\right)\Big/\left(25\,e^{5.934704113458000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)\right)$$

$$\left(\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)e^{-4\times 0.9891173522430000}\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7=$$

$$-\left(\left(42\left(-25\,e^{1.978234704486000}+52\,e^{3.956469408972000}\,\pi^2-25\,e^{1.978234704486000}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)\right)\Big/\left(25\,e^{5.934704113458000}\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)^7\right)\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

From which:

47 *1/(((-1/(((((e^(-4*0.989117352243) / [1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))]^7 * [42(1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))-13*(4Pi^2)/25*e^(2*0.989117352243))]))))))))

Input interpretation:

$$47\left(-\left(1\Big/1\Big/\left(\frac{e^{-4\times 0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}}-13\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}\right)\right)\right)\right)\right)$$

Result:

1.6237116159...

1.6237116159…. result that is an approximation to the value of the golden ratio 1.618033988749...

Series representations:

$$-\left(47 \Big/ 1 \Big/ \left(e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right) \Big/ \left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right) =$$

$$\left(1974\left(-25\,e^{1.978234704486000}+52\,e^{3.956469408972000}\,\pi^2-25\,e^{1.978234704486000}\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)\right) \Big/ \left(25\,e^{5.934704113458000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)^7\right)$$

$$-\left(47\Big/1\Big/\left(e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)=$$

$$\left(1974\left(-25\,e^{1.978234704486000}+52\,e^{3.956469408972000}\,\pi^2-25\,e^{1.978234704486000}\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\right)\Big/\left(25\,e^{5.934704113458000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)$$

$$-\left(47\Big/1\Big/\left(e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)=$$

$$\left(1974\left(-25\,e^{1.978234704486000}+52\,e^{3.956469408972000}\,\pi^2-25\,e^{1.978234704486000}\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)\right)\Big/\left(25\,e^{5.934704113458000}\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)^7\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

And again:

32((((e^(-4*0.989117352243) / [1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))]^7 * [42(1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))-13*(4Pi^2)/25*e^(2*0.989117352243))]))))

Input interpretation:

$$32\left(\frac{e^{-4\times 0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}-13\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}\right)\right)\right)$$

Result:

−1.1055057810...

-1.1055057810….

We note that the result -1.1055057810…. is very near to the value of Cosmological Constant, less 10^{-52} , thence 1.1056, with minus sign

Series representations:

$$
\begin{aligned}
&\Bigg(32\, e^{-4\times 0.9891173522430000} \Bigg(42 \Bigg(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}} - \\
&\qquad \frac{1}{25}\,(4\pi^2)\, 13\, e^{2\times 0.9891173522430000}\Bigg)\Bigg)\Bigg)\Bigg/ \\
&\quad \Bigg(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\Bigg)^7 = \\
&-\Bigg(\Bigg(1344 \Bigg(-25\, e^{1.978234704486000} + 52\, e^{3.956469408972000}\, \pi^2 - \\
&\qquad 25\, e^{1.978234704486000} \sqrt{\frac{4\, e^{1.978234704486000}\, \pi^2}{75}} \\
&\qquad \sum_{k=0}^{\infty} \left(\frac{75}{4}\right)^k \left(e^{1.978234704486000}\, \pi^2\right)^{-k} \binom{\frac{1}{2}}{k}\Bigg)\Bigg)\Bigg/ \Bigg(25\, e^{5.934704113458000} \\
&\qquad \Bigg(1+\sqrt{\frac{4\, e^{1.978234704486000}\, \pi^2}{75}} \sum_{k=0}^{\infty} \left(\frac{75}{4}\right)^k \left(e^{1.978234704486000}\, \pi^2\right)^{-k} \binom{\frac{1}{2}}{k}\Bigg)^7\Bigg)\Bigg)
\end{aligned}
$$

$$\left(32\, e^{-4\times 0.9891173522430000} \left(42 \left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}} - \frac{1}{25}(4\pi^2)\, 13\, e^{2\times 0.9891173522430000}\right)\right)\right) \Big/ \left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7 = -\left(\left(\left(1344 \left(-25\, e^{1.978234704486000} + 52\, e^{3.956469408972000}\, \pi^2 - 25\, e^{1.978234704486000} \sqrt{\frac{4\, e^{1.978234704486000}\, \pi^2}{75}} \sum_{k=0}^{\infty} \frac{\left(-\frac{75}{4}\right)^k \left(e^{1.978234704486000}\, \pi^2\right)^{-k} \left(-\frac{1}{2}\right)_k}{k!}\right)\right) \Big/ \left(25\, e^{5.934704113458000} \left(1+\sqrt{\frac{4\, e^{1.978234704486000}\, \pi^2}{75}} \sum_{k=0}^{\infty} \frac{\left(-\frac{75}{4}\right)^k \left(e^{1.978234704486000}\, \pi^2\right)^{-k} \left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)\right)\right)$$

$$\left(32\, e^{-4\times 0.9891173522430000} \left(42 \left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}} - \frac{1}{25}(4\pi^2)\, 13\, e^{2\times 0.9891173522430000}\right)\right)\right) \Big/ \left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7 = -\left(\left(\left(1344 \left(-25\, e^{1.978234704486000} + 52\, e^{3.956469408972000}\, \pi^2 - 25\, e^{1.978234704486000} \sqrt{z_0} \sum_{k=0}^{\infty} \frac{(-1)^k \left(-\frac{1}{2}\right)_k \left(1+\frac{4\, e^{1.978234704486000}\, \pi^2}{75} - z_0\right)^k z_0^{-k}}{k!}\right)\right) \Big/ \left(25\, e^{5.934704113458000} \left(1+\sqrt{z_0} \sum_{k=0}^{\infty} \frac{(-1)^k \left(-\frac{1}{2}\right)_k \left(1+\frac{4\, e^{1.978234704486000}\, \pi^2}{75} - z_0\right)^k z_0^{-k}}{k!}\right)^7\right)\right)\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

And:

-[32((((e^(-4*0.989117352243) / [1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))]^7 * [42(1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))-13*(4Pi^2)/25*e^(2*0.989117352243))]))))]^5

Input interpretation:

$$-\left(32\left(\frac{e^{-4\times 0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}-13\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}\right)\right)\right)\right)^5$$

Result:

1.651220569...

1.651220569…. result very near to the 14th root of the following Ramanujan's class invariant $Q = \left(G_{505}/G_{101/5}\right)^3$ = 1164.2696 i.e. 1.65578...

Series representations:

$$-\left(\left(32\, e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\, 13\, e^{2\times 0.9891173522430000}\right)\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)^5 =$$

$$\left(4\,385\,270\,057\,140\,224\left(-25+52\, e^{1.978234704486000}\,\pi^2-25\sqrt{\frac{4\, e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)^5\right)\Big/\left(9\,765\,625\, e^{19.78234704486000}\left(1+\sqrt{\frac{4\, e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)^{35}\right)$$

$$-\left(\left(32\, e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\,\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)-\frac{1}{25}(4\,\pi^2)\, 13\, e^{2\times 0.9891173522430000}\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\,\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)^5 = \left(4\,385\,270\,057\,140\,224\left(-25+52\, e^{1.978234704486000}\,\pi^2-25\sqrt{\frac{4\, e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^5\right)\Big/\left(9\,765\,625\, e^{19.78234704486000}\left(1+\sqrt{\frac{4\, e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^{35}\right)$$

$$-\left(\left(32\, e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\,\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)-\frac{1}{25}(4\,\pi^2)\, 13\, e^{2\times 0.9891173522430000}\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\,\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)^5 = \left(4\,385\,270\,057\,140\,224\left(-25+52\, e^{1.978234704486000}\,\pi^2-25\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\, e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)^5\right)\Big/\left(9\,765\,625\, e^{19.78234704486000}\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\, e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)^{35}\right)$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

We obtain also:

-[32((((e^(-4*0.989117352243) / [1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))]^7 * [42(1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))-13*(4Pi^2)/25*e^(2*0.989117352243))])))))]^1/2

Input interpretation:

$$-\sqrt{\left(32\left(\frac{e^{-4\times 0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}\right)^7}\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}}-13\left(\frac{1}{25}\left(4\pi^2\right)\right)e^{2\times 0.989117352243}\right)\right)\right)\right)}$$

Result:

-0

$1.0514303501\ldots\, i$

Polar coordinates:

$r = 1.05143035007$ (radius), $\theta = -90°$ (angle)

1.05143035007

Series representations:

$$-\sqrt{\left(\left(32\,e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right)\middle/\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)}=-\frac{8}{5}\sqrt{21}\sqrt{\left(\left(\left(25-52\,e^{1.978234704486000}\,\pi^2+25\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)\middle/\left(e^{3.956469408972000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)^7\right)\right)\right)}$$

$$-\sqrt{\left(\left(32\,e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}\,(4\,\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)}=-\frac{8}{5}\,\sqrt{21}\,\sqrt{\left(\left(25-52\,e^{1.978234704486000}\,\pi^2+25\,\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\,\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\Big/\left(e^{3.956469408972000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\,\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)\right)}$$

$$-\sqrt{\left(\left(32\,e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}\,(4\,\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\,\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)}=-\frac{8}{5}\,\sqrt{21}\,\sqrt{\left(\left(25-52\,e^{1.978234704486000}\,\pi^2+25\,\sqrt{z_0}\,\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)\Big/\left(e^{3.956469408972000}\left(1+\sqrt{z_0}\,\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)^7\right)\right)}$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

1 / -[32((((e^(-4*0.989117352243) / [1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))]^7 * [42(1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243))))-13*(4Pi^2)/25*e^(2*0.989117352243))])))))]^1/2

Input interpretation:

$$-\left(1\Big/\sqrt{\left(32\left(\frac{e^{-4\times0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^{2}\right)\right)e^{2\times0.989117352243}}\right)^{7}}\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\pi^{2}\right)\right)e^{2\times0.989117352243}}\right)-13\left(\frac{1}{25}\left(4\pi^{2}\right)\right)e^{2\times0.989117352243}\right)\right)\right)}\right)$$

Result:

$0.95108534763\ldots\, i$

Polar coordinates:

$r = 0.95108534763$ (radius), $\theta = 90°$ (angle)

0.95108534763

We know that the primordial fluctuations are consistent with Gaussian purely adiabatic scalar perturbations characterized by a power spectrum with a spectral index $n_s = 0.965 \pm 0.004$, consistent with the predictions of slow-roll, single-field, inflation.

Thence 0.95108534763 is a result very near to the spectral index n_s, to the mesonic Regge slope, to the inflaton value at the end of the inflation 0.9402 and to the value of the following Rogers-Ramanujan continued fraction:

$$\frac{e^{-\frac{\pi}{5}}}{\sqrt{(\varphi-1)\sqrt{5}}-\varphi+1}=1-\cfrac{e^{-\pi}}{1+\cfrac{e^{-2\pi}}{1+\cfrac{e^{-3\pi}}{1+\cfrac{e^{-4\pi}}{1+\ldots}}}}\approx 0.9568666373$$

Series representations:

$$-\left(1\Big/\left(\sqrt{\left(\left(\left(32\,e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right.\right.\right.\right.\right.}\right.\right.$$

$$\left.\left.\left.\left.-\frac{1}{25}\,(4\pi^2)\,13\,e^{2\times 0.9891173522430000}\right)\right)\right)\Big/$$

$$\left.\left.\left.\left.\left(1+\sqrt{1+\frac{(4\pi^2)\,e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)\right)\right)\right)=$$

$$-\left(5\Big/\left(8\sqrt{21}\,\sqrt{\left(\left(\left(25-52\,e^{1.978234704486000}\,\pi^2+25\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\right.\right.\right.}\right.\right.$$

$$\left.\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)\Big/$$

$$\left(e^{3.956469408972000}\left(1+\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\right.\right.$$

$$\left.\left.\left.\left.\left.\left.\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}\right)^7\right)\right)\right)\right)\right)$$

$$-\left(1\middle/\left(\sqrt{\left(\left(32\, e^{-4\times 0.9891173522430000}\left(42\left(1+\sqrt{1+\frac{(4\,\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}-\frac{1}{25}\,(4\,\pi^2)\,13\, e^{2\times 0.9891173522430000}\right)\right)\right)\middle/\left(1+\sqrt{1+\frac{(4\,\pi^2)\, e^{2\times 0.9891173522430000}}{3\times 25}}\right)^7\right)}\right)\right)=$$

$$-\left(5\middle/\left(8\,\sqrt{21}\,\sqrt{\left(\left(25-52\, e^{1.978234704486000}\,\pi^2+25\,\sqrt{\frac{4\, e^{1.978234704486000}\,\pi^2}{75}}\,\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)\middle/\left(e^{3.956469408972000}\left(1+\sqrt{\frac{4\, e^{1.978234704486000}\,\pi^2}{75}}\,\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}\right)^7\right)\right)}\right)\right)$$

$$-\left(1\Big/\left(\sqrt{\left(\left(32\, e^{-4\times 0.98911735224300000}\left(42\left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.98911735224300000}}{3\times 25}}-\frac{1}{25}(4\pi^2)\, 13\, e^{2\times 0.98911735224300000}\right)\right)\right)\Big/\left(1+\sqrt{1+\frac{(4\pi^2)\, e^{2\times 0.98911735224300000}}{3\times 25}}\right)^7\right)}\right)\right)=$$

$$-\left(5\Big/\left(8\sqrt{21}\sqrt{\left(\left(25-52\, e^{1.9782347044486000}\,\pi^2+25\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\, e^{1.9782347044486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)\Big/\left(e^{3.9564694089720000}\left(1+\sqrt{z_0}\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\, e^{1.9782347044486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}\right)^7\right)\right)}\right)\right)$$

for $(\text{not }(z_0\in\mathbb{R}\text{ and }-\infty<z_0\leq 0))$

From the previous expression

$$\frac{e^{-4\times 0.989117352243}}{\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}}\right)^7\left(42\left(1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}}-13\left(\frac{1}{25}(4\pi^2)\right)e^{2\times 0.989117352243}\right)\right)}$$

= -0.034547055658…

we have also:

1+1/(((4((2*e^(-0.989117352243/2))) / ((((1+sqrt(((1+1/3*(4Pi^2)/25*e^(2*0.989117352243)))))))))) + (-0.034547055658)

Input interpretation:

$$1+\frac{1}{4\times\frac{2\,e^{-0.989117352243/2}}{1+\sqrt{1+\frac{1}{3}\left(\frac{1}{25}\left(4\,\pi^2\right)\right)e^{2\times 0.989117352243}}}}-0.034547055658$$

Result:

1.61976215705...

1.61976215705….. result that is a very good approximation to the value of the golden ratio 1.618033988749...

Series representations:

$$1+\frac{1}{\frac{4\left(2\,e^{-0.98911735224300000/2}\right)}{1+\sqrt{1+\frac{\left(4\,\pi^2\right)e^{2\times 0.98911735224300000}}{3\times 25}}}}-0.03454705565800000=$$

$$0.9654529443420000+\frac{e^{0.4945586761215000}}{8}+\frac{1}{8}\,e^{0.4945586761215000}$$
$$\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\left(\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\binom{\frac{1}{2}}{k}$$

$$1+\frac{1}{\frac{4\left(2\,e^{-0.98911735224300000/2}\right)}{1+\sqrt{1+\frac{\left(4\,\pi^2\right)e^{2\times 0.98911735224300000}}{3\times 25}}}}-0.03454705565800000=$$

$$0.9654529443420000+\frac{e^{0.4945586761215000}}{8}+\frac{1}{8}\,e^{0.4945586761215000}$$
$$\sqrt{\frac{4\,e^{1.978234704486000}\,\pi^2}{75}}\sum_{k=0}^{\infty}\frac{\left(-\frac{75}{4}\right)^k\left(e^{1.978234704486000}\,\pi^2\right)^{-k}\left(-\frac{1}{2}\right)_k}{k!}$$

$$1+\frac{1}{\frac{4\left(2\,e^{-0.9891173522430000/2}\right)}{1+\sqrt{1+\frac{\left(4\,\pi^2\right)e^{2\times0.9891173522430000}}{3\times25}}}}-0.0345470556580000=$$

$$0.9654529443420000+\frac{e^{0.4945586761215000}}{8}+$$

$$\frac{1}{8}\,e^{0.4945586761215000}\,\sqrt{z_0}\,\sum_{k=0}^{\infty}\frac{(-1)^k\left(-\frac{1}{2}\right)_k\left(1+\frac{4\,e^{1.978234704486000}\,\pi^2}{75}-z_0\right)^k z_0^{-k}}{k!}$$

for (not ($z_0 \in \mathbb{R}$ and $-\infty < z_0 \leq 0$))

Observations

We note that, from the number 8, we obtain as follows:

8^2

64

$8^2 \times 2 \times 8$

1024

$8^4 = 8^2 \times 2^6$

True

$8^4 = 4096$

$8^2 \times 2^6 = 4096$

$2^{13} = 2 \times 8^4$

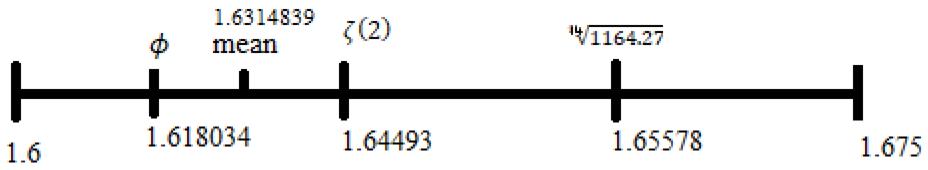
True

$2^{13} = 8192$

$2 \times 8^4 = 8192$

We notice how from the numbers 8 and 2 we get 64, 1024, 4096 and 8192, and that 8 is the fundamental number. In fact $8^2 = 64$, $8^3 = 512$, $8^4 = 4096$. We define it "fundamental number", since 8 is a Fibonacci number, which by rule, divided by the previous one, which is 5, gives 1.6 , a value that tends to the golden ratio, as for all numbers in the Fibonacci sequence

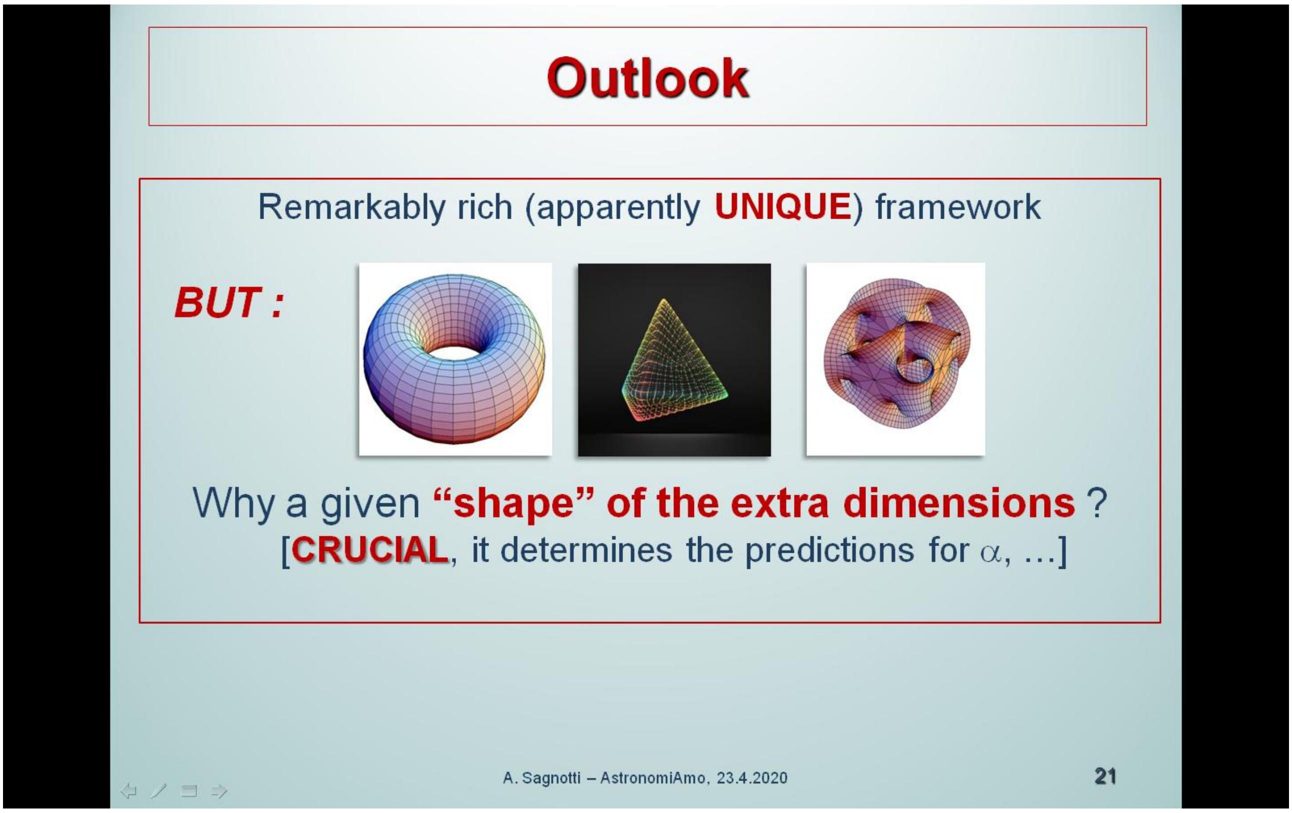
“Golden” Range



Finally we note how $8^2 = 64$, multiplied by 27, to which we add 1, is equal to 1729, the so-called "Hardy-Ramanujan number". Then taking the 15th root of 1729, we obtain a value close to ζ(2) that 1.6438 ..., which, in turn, is included in the range of what we call "golden numbers"

Furthermore for all the results very near to 1728 or 1729, adding $64 = 8^2$, one obtain values about equal to 1792 or 1793. These are values almost equal to the Planck multipole spectrum frequency 1792.35 and to the hypothetical Gluino mass

Appendix



Outlook

Remarkably rich (apparently **UNIQUE**) framework

BUT :

Why a given **"shape" of the extra dimensions** ?

[**CRUCIAL**, it determines the predictions for α, …]

From: *A. Sagnotti – AstronomiAmo, 23.04.2020*

In the above figure, it is said that: "why a given shape of the extra dimensions? Crucial, it determines the predictions for α".

We propose that whatever shape the compactified dimensions are, their geometry must be based on the values of the golden ratio and ζ(2), (the latter connected to 1728 or 1729, whose fifteenth root provides an excellent approximation to the above mentioned value) which are recurrent as solutions of the equations that we are going to develop. It is important to specify that the initial conditions are **always** values belonging to a fundamental chapter of the work of S. Ramanujan "Modular equations and Appoximations to Pi" (see references). These values are some multiples of 8 (64 and 4096), 276, which added to 4096, is equal to 4372, and finally $e^{\pi\sqrt{22}}$

We have, in certain cases, the following connections:

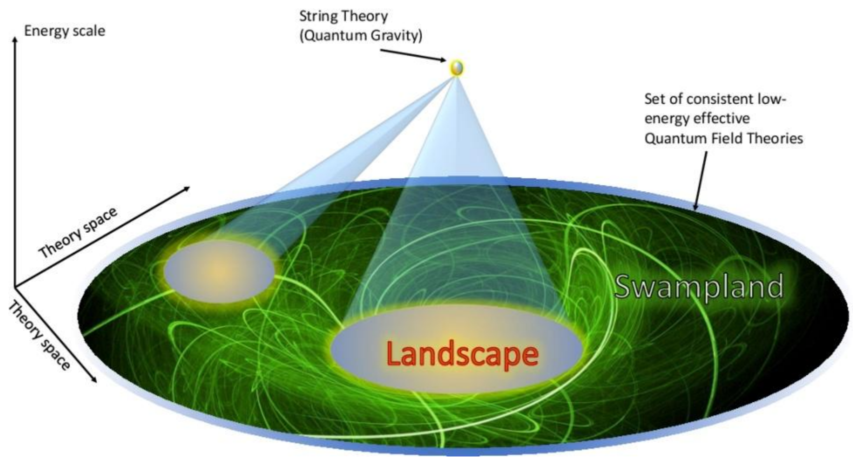
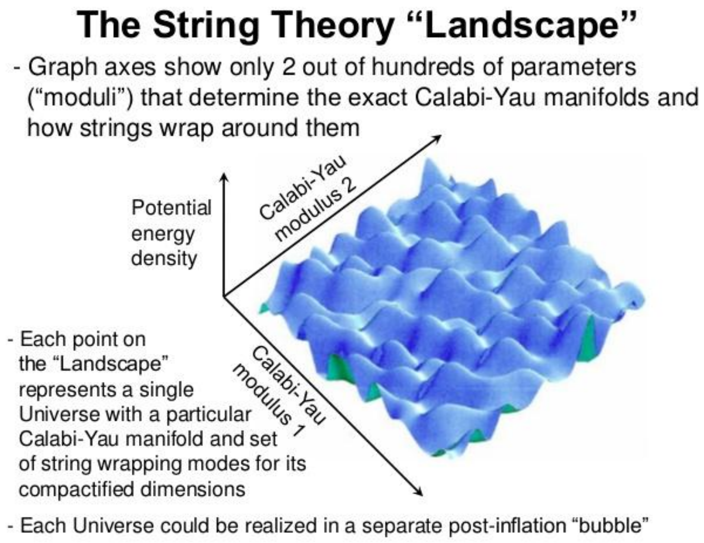


Fig. 1



The String Theory "Landscape"

- Graph axes show only 2 out of hundreds of parameters ("moduli") that determine the exact Calabi-Yau manifolds and how strings wrap around them

Potential energy density
Calabi-Yau modulus 2
Calabi-Yau modulus 1

- Each point on the "Landscape" represents a single Universe with a particular Calabi-Yau manifold and set of string wrapping modes for its compactified dimensions
- Each Universe could be realized in a separate post-inflation "bubble"

Fig. 2

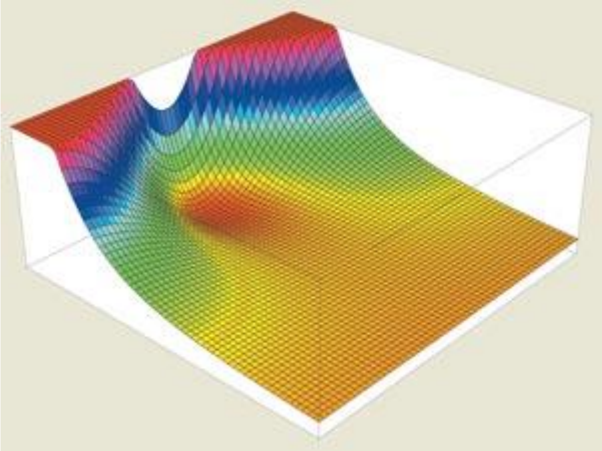


Fig. 3

Stringscape - a small part of the string-theory landscape showing the new de Sitter solution as a local minimum of the energy (vertical axis). The global minimum occurs at the infinite size of the extra dimensions on the extreme right of the figure.

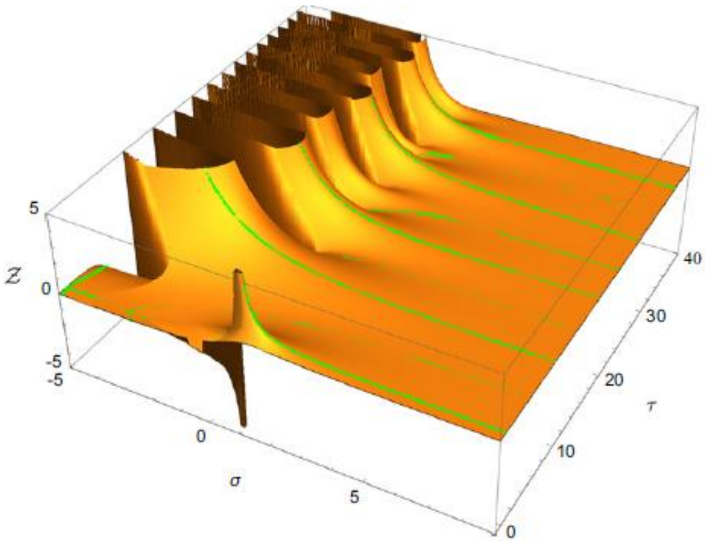


Figure 2. Lines in the complex plane where the Riemann zeta function ζ is real (green) depicted on a relief representing the positive absolute value of ζ for arguments $s \equiv \sigma + \mathrm{i}\tau$ where the real part of ζ is positive, and the negative absolute value of ζ where the real part of ζ is negative. This representation brings out most clearly that the lines of constant phase corresponding to phases of integer multiples of 2π run down the hills on the left-hand side, turn around on the right and terminate in the non-trivial zeros. This pattern repeats itself infinitely many times. The points of arrival and departure on the right-hand side of the picture are equally spaced and given by equation (11).

Fig. 4

With regard the Fig. 4 the points of arrival and departure on the right-hand side of the picture are equally spaced and given by the following equation:

$$\tau'_k \equiv k \, \frac{\pi}{\ln 2},$$

with $k = \ldots, -2, -1, 0, 1, 2, \ldots.$

we obtain:

2Pi/(ln(2))

Input:

$$2 \times \frac{\pi}{\log(2)}$$

Exact result:

$$\frac{2\pi}{\log(2)}$$

Decimal approximation:

9.0647202836543876192553658914333336203437229354475911683720330958
…

9.06472028365….

Alternative representations:

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\log_e(2)}$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\log(a)\log_a(2)}$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{2\coth^{-1}(3)}$$

Series representations:

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{2\,i\,\pi\left\lfloor\frac{\arg(2-x)}{2\pi}\right\rfloor + \log(x) - \sum_{k=1}^{\infty}\frac{(-1)^k\,(2-x)^k\,x^{-k}}{k}} \quad \text{for } x < 0$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\log(z_0) + \left\lfloor\frac{\arg(2-z_0)}{2\pi}\right\rfloor\left(\log\left(\frac{1}{z_0}\right) + \log(z_0)\right) - \sum_{k=1}^{\infty}\frac{(-1)^k\,(2-z_0)^k\,z_0^{-k}}{k}}$$

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{2\,i\,\pi\left\lfloor\frac{\pi-\arg\left(\frac{1}{z_0}\right)-\arg(z_0)}{2\pi}\right\rfloor + \log(z_0) - \sum_{k=1}^{\infty}\frac{(-1)^k\,(2-z_0)^k\,z_0^{-k}}{k}}$$

Integral representations:

$$\frac{2\pi}{\log(2)} = \frac{2\pi}{\int_1^2 \frac{1}{t}\,dt}$$

$$\frac{2\pi}{\log(2)} = \frac{4\,i\,\pi^2}{\int_{-i\,\infty+\gamma}^{i\,\infty+\gamma}\frac{\Gamma(-s)^2\,\Gamma(1+s)}{\Gamma(1-s)}\,ds} \quad \text{for } -1 < \gamma < 0$$

From which:

(2Pi/(ln(2)))*(1/12 π log(2))

Input:

$$\left(2\times\frac{\pi}{\log(2)}\right)\left(\frac{1}{12}\,\pi\log(2)\right)$$

$\log(x)$ is the natural logarithm

Exact result:

$$\frac{\pi^2}{6}$$

Decimal approximation:

1.6449340668482264364724151666460251892189499012067984377355582293
…

1.6449340668…. = ζ(2) = $\frac{\pi^2}{6}$ = 1.644934 ...

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